149329
JUN 21 1884
SMITHSONIAN INSTITUTION

THE AMERICAN

GAS LIGHT JOURNAL

REDMAN & KENNY, N.Y.

PUBLISHING OFFICE No. 42 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, VENTILATION, WATER SUPPLY AND DISTRIBUTION, & GENERAL SCIENCE.

VOLUME XL.—No 8.
Whole No. 596.

NEW YORK, WEDNESDAY, APRIL 16, 1884.

$3 PER ANNUM
IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager.
JOS. R. THOMAS, C.E., Editor.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND CLASS MATTER.

Published on the 2d and 16th of each month, at No. 42 Pine Street, N. Y.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $3.50 (15 shillings—18 francs). All payments to be made in advance. Single copies, 15 cents.

Books.—We will mail, post-paid, at publisher's lowest rates, any book—scientific or otherwise—to any address in the United States or Canada. No books will be sent C. O. D.

Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

The American News Company, Nos. 39 and 41 Chambers street, New York, are agents for this JOURNAL. Newsdealers will send orders to them.

Collections are invariably made directly from this office, for subscriptions, advertisements, etc. We have agents to solicit the same, but they are not authorized to receipt for money.

Remittances should be made either by post-office order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

CONTENTS.

An Asterisk (*) denotes an illustrated article.

OFFICIAL NOTICES—
Central New York Gas Engineers Association 177
Annual Meeting of the Western Gas Association 177

EDITORIALS—
Some Suggestions Upon the Paper Recently Read by Mr. Stiness. 177
Obituary—Mr. Thomas Hersey 178
New Manufacturing Enterprise 178
Washington (D. C.) Opposition Scheme "Sat Upon" 178
Fourteenth Annual Meeting of the New England Association of Gas Engineers—Official Report—Continued from page 155 179
Vigilance is the Price of Success in Gas Making—Appointment of Special Committees—The Weakening of Mains by Tapping.
A Suggestion Concerning the Patent Gas Man—By Frederic Egner. 184
*Notes on Purification—J. W. Helps 184
Report of the Board of Public Interests on the Richmond (Va.) Gas Works 186

ITEMS OF INTEREST FROM VARIOUS LOCALITIES 187
Personal—Francis H. Jackson—Gas Matters at Muncie, Ind.—Personal—Benjamin Rankin—Annual Meeting of the American Water Works Association—Not Water Gas—Price of Gas Reduced at Hannibal, Mo.—Some of the Lowe Candle Power Gets "Lost" at Harrisburg, Pa.—The Fatal Kerosene and Festive Benzine—Mr. John P. Harbison, of Hartford, Conn., Heard from—Buoys Lighted with Compressed Gas—The Nassau Gas Light Company, of Brooklyn (N. Y.) Ceases Aggressive Operations—A Decidedly Wrong Statement Corrected—Street Lighting at Toronto, Canada—Some Facts from Superintendent McCormick's Report—Messrs. Perkins & Co., Located in New Offices—The Sheldon Gas Stove Company's Recent Exhibit.

CORRESPONDENCE—
"J. S." not Disposed to Admit that His Reasoning is Fallacious.. 189
The Market for Gas Securities.. 190

[OFFICIAL NOTICE.]

Central New York Gas Engineers Association.

SYRACUSE, NEW YORK, April 4, 1884.

The Fifth Annual Meeting of the Central New York Gas Engineers Association will be held at Corning, New York, Thursday, May 22, 1884. The meeting will be called to order, at the Dickinson House, at 10 A. M. Members will please notify the Secretary, on or before Thursday, May 15, of their intention to be present. Active membership in the Association is open to all persons interested in gas manufacture in Central and Western New York, and all such are invited to join. A cordial invitation to members of other Associations, to be present at our meeting, is hereby extended.

W. A. WOOD, *Secretary.*

[OFFICIAL NOTICE.]

Annual Meeting of the Western Gas Association.

SECRETARY'S OFFICE, WESTERN GAS ASSOCIATION,
QUINCY, ILLS., April 12, 1884.

The Seventh Annual Meeting of the Western Gas Association will be held at St. Louis, Mo., on the 14th, 15th, and 16th days of May. The Southern Hotel has been chosen for our entertainment, and the rates will be as follows: $3.50 per day for outside, and $3 for interior rooms; a material concession from the regular rates charged at the Southern.

The meeting promises to be of marked interest, as a liberal presentation of papers is already assured, while the attendance will without doubt be very large. In the next issue of the JOURNAL will be given a list of the papers which will be read, accompanied by the names of the authors. I ask, as an especial favor, of those who are preparing papers for our forthcoming meeting, that they will kindly inform me at once of the titles of their essays.

The Secretary will take pleasure in forwarding blank forms of application to those who will inform him of their desire to become members of our organization.

A. W. LITTLETON, Secretary.

SOME SUGGESTIONS UPON THE PAPER RECENTLY READ BY MR. STINESS.

The paper presented and read by Mr. Samuel G. Stiness, at the late Boston meeting of the New England Association of Gas Engineers, giving a description of the new plant (as well as detailing the practical results obtained up to that time in its operation) erected some time since for the Pawtucket Gas Light Company, of Pawtucket, R. I., we submit was one of the sort well calculated to be of great interest to those engaged in the business of gas manufacture, furnishing, as it unostentatiously does, a plain, readable, and concise statement of what the author was enabled to accomplish under his new and improved conditions of working.

What we desire to call more particular attention to, in connection with the paper, is the suggestion made by Mr. Stiness about remedying defects in hydraulic main construction, giving due heed to the plan advanced by him. The author proposes, in illustrating a method toward accomplishing the object in view, that the hydraulic main be made tapering on the lower line, increasing in depth toward the outlet end, or ends, from which outlets the thickest and heaviest portions of the tar accumulating during carboniza-

tion could be constantly and easily carried off, with the further advantage of preventing pitchy formations at bottom of main. That this style of construction would be a step in the right direction we have no hesitation in asserting. The heavier tarry substances being continuously drawn off, the gas, in its delivery from the retorts, would only be required to find its way through whatever accumulation of the lighter products that were given off in the distillation, thus missing the resistance now experienced from contact with both the heavy and light obstructive matters.

The hydraulic main acts the part of an important factor in the manufacture of illuminating gas, both as regards quantity of yield and candle power of the resultant product of coal carbonized, and undoubtedly has more to do with stoppages in standpipes than it has ever been credited with. This, by reason of its not properly receiving the passing gas, or of failing, in like manner, to transmit, with ease and freedom, its ephemeral visitor to the succeeding sequence of apparatus. Either one of these defects may be brought about through lack of sufficient capacity in the main itself, causing failure of the vessel to pass the gas off as freely and quickly as manufactured; or of placing the dip-pipes too closely to the bottom of main, thus enhancing, indeed almost surely making possible, the accumulation of obstructions underneath the dip-pipe exits. Again by placing the main in too near proximity to the benches. This operation subjects the hydraulic to excessive degree of heat, and causes it to act more in the nature of a tar distillery, than it does towards accomplishing the purpose for which it was intended, namely—simply to act as a seal to the retorts, and prevent the gas returning to them after having once been discharged into the main.

In the list of causes noted as likely to breed trouble, let us produce a few figures to show how lack of capacity in main is a serious matter. Many circular-shaped mains are now in use, not over 14 inches inside diameter, giving an available working capacity of about only 43 square inches, while, at the same time, hey are expected to take off the product of gas from ten to twelve benches. Supposing there be a stack of ten benches of threes, connected with a 14-inch hydraulic, and the pipe about the benches to be 5 inches in diameter, the total area of the pipe entering main would be 589 square inches, or nearly 13¾ times capacity of hydraulic when all the benches were working. The second source of danger—placing the dip pipe too near the bottom of main—operates disadvantageously from the fact that such construction favors deposits of hard tar around the dip exits, preventing free delivery of gas from the retorts, with the further tendency of facilitating stopped standpipes and loading the carbonizing vessels with hard carbon.

In the third instance given we frequenly find, from a false economy in construction, that too little dead work is put in above the arches and that bottom of hydraulic is located too closely to brickwork making the vessel resemble, in its actual working operation, a tar distillery. The over-abundance of pitch likely to be produced causes great vexation and loss, through gradual and certain reduction of main capacity, the deposits soon becoming so great as to entail stoppage of work until they may forcibly be dislodged.

There can be no saving in a system of construction that neglects to interpose sufficient depth of dead-work over arches, since the continual loss of radiant heat from the tops of benches not sufficiently covered can be saved to do its proper work inside the ovens by the requisite addition of masonry.

We would advise that, under no condition or circumstance, should the dead-work over the arches be less than 18 inches, if the full benent of retaining the greatest possible proportion of the generated heat is to be secured.

Let us illustrate what might be done, towards an attempt at constructing a hydraulic main tapering from center to both ends, taking, as an example, a stack of, say, ten benches of sixes. In a case of this kind the proper slope could be effected by building the main 6 inches deeper at the gas and tar outlet ends than in the middle—it being understood that the proposed main be equipped with the end in view of delivering the gas and tar from both extremities. Such a main will enable the ready drawing off of the thick tars at the lowest points of the slope. Working in this manner, with the connecting pipes from retorts of ample size, better results, both as to quantity and quality of the gas product, would be reached.

The question may naturally arise, what would be considered an amply sized connection to insure free delivery of the gas manufactured. We may answer this by saying such amplitude is not likely to be gained by employing sizes of connecting pipes calculated to pass a make of 3,000 or 4,000 cubic feet per retort per diem, and then taking for granted that a similar-sized connection will as readily take up a make, from benches as now constructed, of from 9,000 to 10,000 cubic feet in the same period of time. With retorts of the last mentioned category, the standpipes should not be less than 8 inches inside diameter. With auxiliary connections of this diameter each would have an area of 50 square inches, or a total area, in the thirty pipes on each section of hydraulic, of 1,500 square inches. A hydraulic main $24'' \times 30'' \times 36''$ in the clear would have an available area in the cross-section (less the plane taken out by dip-pipe) of 360 square inches, or a little less than one-fourth possessed by the standpipes.

These figures prove the necessity of having the exhauster perform its work thoroughly, and also go to show that the *outlet* pipes from hydraulic main should be sufficiently large to assist the exhauster as much as possible in its labor. Outlet pipes for benches of the description under discussion should not be less than 20 inches inside diameter, thus giving them an area of 314 square inches. With connecting pipes having the diameters enumerated, the conditions advanced above being equal, the benefits accruing to the manufacturer would soon be manifested.

We may say, in conclusion, as Mr. Stiness does not seek to patent the main recommended by him, any one who may desire to test its efficacy can do so without fear of being troubled in the future by a demand for royalties as a consequence of its adoption.

OBITUARY—MR. THOMAS HERSEY.

We regret to announce the death of Mr. Thomas Hersey, of the widely-known gas engineering firm of Kirkham and Hersey, London, England. The deceased gentleman was born in August, 1821, and early entered the service of the Imperial Gas Light and Coke Company, occupying, at the outset, the position of store clerk at the St. Pancras works, speedily reaching to the responsible office of Chief Distributing Engineer, continuing as such for some years after the amalgamation of the Imperial Company with the Chartered Company—now The Gas Light and Coke Company.

On retiring from active participation in the Chartered Company's affairs, Mr. Hersey entered into a partnership with Mr. Thomas Nesham Kirkham, ex-Chief Engineer of the Imperial Company. Amongst this firm's various undertakings, in connection with the gas industry, may be mentioned the introduction of the Standard Washer-Scrubber. The value and importance of this adjunct to gas manufacturing (Mr. George Shepard Page's efforts have made these qualities know to the faternity in America) were so speedily appreciated that it became necessary to extend the facilities for their quick supply, and so the concern of Kirkham, Hulett and Chandler was incorporated, of which corporation Mr. Hersey was managing director. Mr. Hersey was also connected with the *Review of Gas and Water Engineering* in a similar capacity to that held by him in the Kirkham, Hulett and Chandler Company.

The deceased gentleman experienced a stroke of paralysis some months ago; owing to the seeming lightness of the attack, judged from the apparent ease with which he recovered from its effects, it was deemed certain that many busy years were yet before him. These calculations, unhappily, were dissipated, a second stroke of the fell complaint causing him to succumb, on March 25th last, after a prostration of four days' duration. Mr. Hersey's estimable wife survives him, and the other mourners of his own immediate family are six sons and three daughters. To this sorrowing group may be added his numberless personal friends scattered, without any attempt at exaggeration, over every part of the earth where the art of the gas maker is practiced.

New Manufacturing Enterprise.

Mr. J. Anderson has severed his connection with the firm of Taylor and Anderson, otherwise known as the Cincinnati Gas Retort and Fire Brick Company, of Cincinnati, Ohio. Although Mr. Anderson has ceased to take active or passive part in the doings of above company, it is by no means the intention of the gentleman to retire from the fire clay goods field, since he has just organized a new corporation entitled the "Standard Gas Retort and Fire Brick Company. The officers of the new firm are Messrs. J. Anderson, President and Manager; Joseph H. Campbell, Vice-President; R. A. Kirker, Secretary and Treasurer. Mr. Anderson's manufacturing base will be located at Ironton, Ohio, a territory well-adapted for the particular business in hand. Factory buildings of large capacity have been purchased, and these are in close proximity to almost unlimited supplies of fine qualities of fire clays and cheap coals wherewith to work the clays up. Ironton is the center of a large local market, and numbers among its industries extensive iron smelting furnaces and rolling mills. Mr. Anderson is now engaged in selecting a suitable office and sales headquarters in Cincinnati, Ohio.

Wshington (D. C.) Opposition Scheme "Sat Upon."

If we do not very greatly mistake, some Philadelphia prophets, even worse than the Vennor stripe—judge from that how bad they are—promised that "the next President would be a user of water gas," no doubt basing such assertion on the premise that certain speculators would be successful in their endeavors to obtain an opposition charter. Philadelphia, we opine, is a pretty firm believer in the benefits of protection, and people generally incline to the idea that the present House of Congress displays a tendency to advocate free trade doctrines; but the particular Congressmen composing the Committee on the District of Columbia were not slow in declaring that the best interests of the District would be subserved by "protecting" the Washington Company from the latest (we think the attempt just "sat down upon" numbers 26!) endeavors of the "howling philanthropists," so anxious to divide the business of the old company, and standing by the corporation which always evidenced a willingness to do what was right and fair by the Washington gas consumer. We will give the report of committee in next issue.

[Official Report.—Continued from page 155.]

Fourteenth Annual Meeting of the New England Association of Gas Engineers.

Held at Young's Hotel, Boston, Mass., Feb. 20 and 21, 1884.

Second Day—Morning Session—Feb. 21.

When the report of the Committee on President Slater's address, with recommendations, was received and adopted, the Chairman stated he would appoint the committees called for by the report some time later on, and then announced that the business next in order would be the reading of two papers which the Association had allowed to be withdrawn from the prize competition. The authors' names not having been made public, Secretary Neal was called upon to read the first paper, entitled

Vigilance is the Price of Success in Gas Making.

In these days of active competition, when gas managers must be alert to seize upon every point, however slight, that will be to their advantage in placing gas where it will prove the successful illuminant over all its rivals, everything must be done that will make it the cheapest and most convenient light procurable. While too much cannot be done in the manufacturing department to cheapen the cost of manufacture and facilitate the methods of production, and the manager must strain every nerve and muscle to promote economy and proficiency in the retort house and purifying department, he must also give some of his time and attention to the proper distribution of his gas, so that, after he has produced a good article, it will not fail because of the want of proper facilities for burning it.

One point on which companies are apt to be careless and negligent, particularly small concerns, is the strict inspection of gas piping in new buildings. No company, however small, can afford to be without a system of inspection over the new piping in the districts supplied by its works. There is so much inefficient and dishonest work done by contractors (and gas-pipers are no exception to the rule) that without strict and expert inspection we never know whether it is safe to let gas into a new building, or we may arrive at the knowledge that it is not safe, when too late to profit by it. A case once came to our notice, that occurred in a town where the company, sending out about 6,000,000 feet per annum, did not require any inspection of pipe even so much as to see if it were tight; the consequence being that the gas was turned on in a building, and when the first bill came in it was simply enormous. Naturally the customer objected to paying for any such rate of consumption, since he knew he could not have burned all the gas charged for, and, further, could not afford to.

On investigation a very peculiar state of affairs was found to exist. While there was not the least smell of gas to be perceived about the premises, on watching the meter it was found that the instrument was passing one-half foot of gas per minute.

The leak, wherever it was, must have been situated where the most perfect ventilation prevailed, for, though search was made from attic to cellar, they were unable to find the least clue to it, and the result was, the company lost one who would have proved a valuable consumer.

The inspection should be not only to see that the job is tight; but should be minute and exhaustive in all of its details. It should be seen to that pipe is put up in a workmanlike manner. One of the most important points to be made sure of is, that the pipe be of the right sizes. Nothing is more aggravating to a person than to want to light up to the full extent of his burners, and then discover there is gas enough for only one-half the number. One way of instituting a uniform system of piping in a place is to have a table of sizes of pipe adopted by this Association, which will be found ample, printed upon convenient cards, with such other hints as may be thought desirable, these cards to be distributed among the gas-fitters and plumbers of the town.

Do not deem a glance over the building, and calling the pipe all right, sufficient. Commence at the rising main; follow that and all the services to the end of each, and know that the size of each is up to standard. See that there are no traps left to ultimately fill up, and fill the owner with wrath. See that each bracket supply is securely fastened, and that the nipple is of the proper length. Anyone who has had the misfortune to have a bracket removed for any cause, and had the nipple come off with it, and had the pipe slip out of place, and has then tried to get the nipple back, will appreciate the force of this advice. After a finished and papered wall has had to be cut once or twice to recover the stray pipe, the proprietor will be apt to get somewhat out of conceit with a mode of illumination giving such trouble and annoyance. See that the pendant nipples are firmly fastened and plumb. If not the former, the motion of the chandeliers is apt to start a joint and set it leaking; and if not the latter, they are another source of trouble. It is rather irritating to one's feelings to have the artistic effect of a nicely finished ceiling and center-piece destroyed by having a chandelier standing off at an angle of anywhere from 10 to 45 degrees, simply because the pendant nipple was improperly placed at the outset. We knew of such an occurrence happening in a place where they practiced inspection—but were somewhat slack about it. A job of plumbing in a fine house had been passed upon, and the building finished to the point of putting in the gas fixtures. One elegant chandelier, when screwed on, hung nowhere near plumb, so that the center-piece had to be spoiled to set things right, and the owner of the building was justly aggravated. It so happened that the inspector was at work in the neighborhood, and he heard of the occurrence in a way he never forgot.

Another point is to see that the pipe is put together with red lead joints. Do not allow any gas-fitter's cements about the job either on the joints or on the small leaks occasioned by cracked pipes or sand holes in the fittings; it is an uncertain quantity to put one's trust in. Cement joints are so brittle, that a slight jar cracks them off; and, in a short time, gas will soften them and escape. We have known of this happening, inside of six weeks, where a leak was stopped with cement; and jobs that were put together with this preparation on the joints have been taken apart with the hand in cases where buildings were being repaired. Require an absolutely tight job, just as you would for steam, and then rest in peace and security, for such a job will never leak.

The principle of inspection is so plain as to make it strange there should be a single company not practicing it. The inspector is a middle man, or referee, who stands as the friend of both parties—the fitter and consumer; and the true interests of both are served by him. The former, in case of dispute, has him to fall back upon, and the latter's welfare is safe in his hands. There is hardly one consumer out of ten that knows or thinks anything about this subject; and it is right there should be an experienced party to look after his interests.

In conclusion, it is for the best interests of gas companies to make good gas, and sell it cheap. Keep their customers contented and satisfied, see that they have no cause for trouble or annoyance, and the danger of consumers seeking other and better modes of illumination will be reduced to a minimum.

Discussion.

Mr. Cabot moved a vote of thanks (carried) to the unknown writer of the paper, suggesting that the author need not have concealed his name because of any lack of merit in the production. Mr. Cabot then went on to say there were some things in the paper going to show that the author was not over-familiar with the Association's doings. Some years ago the Association adopted a size of service pipes to be used by the members, and he (the speaker) supposed most of the gentlemen connected with the Association employed this schedule. It is a pretty important subject; and he had occasion to show a gentleman out of the office one day, which unpleasant duty had been forced upon him because of a controversy growing out of the self-same topic. In a large and valuable residence in Lawrence (Mass.) the gas-pipes had been tested and found to be tight. A short time afterwards, when we came to place the meter, the existence of a leak in some part of the service was noted. The owner was moving into the house; wanting to put his carpets down, he became very much disturbed upon our refusal to set the meter until the leak was located and remedied, he insisted upon having the connection made, asserting that he would assume all the risk. We told him that we did not want anyone to take the risk; that the meter would not be connected until every joint was tight. The subsequent discussion was such (he was a very hot-spoken little gentleman, now a prominent lawyer in New York city) that I had to show him the door; he, however, was gentleman enough to come back next day and apologize. It took three days to find the source of escape, and nearly every floor in the house had to be taken up; the trouble finally being located in an imperfect pipe, which defect had been covered up, by a rascally plumber, with wax! When the test-pump was first applied the wax remained in position; but during the nailing down of the carpets the wax, unfortunately or providentially, got "knocked out."

The President—I think Mr. Cabot misunderstood the reading of the paper in regard to the author not having been aware of the present rules of the Association with reference to sizes of pipes. The writer suggests the proper way of instituting an effective means of keeping in mind the pipe sizes adopted by the members of the Association would be to have the same printed upon a conveniently-sized card, with such other hints included as might be thought desirable, then have these cards distributed amongst the plumbers of the various towns.

Mr. Cabot.—I think it would be well to follow such a course.

The President—Some years ago there occurred in this city (Boston) a rather curious example of piping. A gentleman occupying a house in the southern section of the city decided to vacate the premises, and, before doing so, quite naturally took down all the gas fixtures; but, quite unnaturally, failed to plug the bottoms of the chandelier supply-pipes. The next person to occupy the premises just papered over the ceilings, leaving the vents uncapped by anything save the paper veneer. Not knowing anything about

the trap, when the new comer applied to have the gas turned on, we did so; and, as was to be expected, a most disastrous explosion speedily ensued.

Mr. Brayton—I would like to ask if the intention of the author of the paper is simply to have the piping tested. Why may we not go a step farther, and include the entire fixtures as they are put on. In some places, I know, it is customary to defer testing until the fixtures are properly hung. In other places no examination is made of fixtures, the piping alone being subjected to test. This, I submit, leaves great room for danger. My attention was recently called to the case of a new house, which had been occupied only one month, the occupants at the end of that time being called upon pay what seemed a very large gas bill. I made a personal investigation of of the case, and found the meter recording an escape of about one foot of gas in seven hours, with no lights burning. The piping had been properly tested; I having seen to that myself. The escape was traced to a leaky bracket. We should not lose control of the gas until it reaches the burner. The electric light people in our town will not put in their light unless they have control from place of manufacture to point of consumption; and that gives them a decided advantage over a gas company which has no control over the supply after it leaves the meter.

Mr. Thomas—The usual method of testing applies to pipes and not to fixtures. If there be a leak in a fixture it is very readily discovered; and it is objectionable to test fixtures in a house. I would not test them in such manner, since, to make a test, you have to screw the taps so tight that damage might be caused them. Oftentimes, in looking after these things, we should carefully watch the workmen engaged on the job to see that the work is not slighted. I have known sometimes of fitters who would intentionally stop up the pump, thus readily showing pressure on test-pump, but as far as the piping was concerned the pump might as well be in Africa. The proper way to make an examination is to go through the building and take the caps off, thus proving the pressure, not trusting entirely even to the pump. I think it is very objectionable to use the pump in testing fixtures.

Mr. Harbison—In what way are the fixtures injured in testing? In what way, besides tightening up the cocks, is any burner or fixture likely to be injured by the process of pump-test?

Mr. Thomas—You can test a chandelier quite readily by applying a light, and by exerting sense of smell. Is that what you ask?

Mr. Harbison—I do not see, if there is a sand-hole in a pipe leading down from the ceiling towards the burner, how such can be discovered by applying a light and passing it over the pipe from point to point, as people would be likely to do in making that kind of search.

Mr. Thomas—The fixtures can be tested easily for sand holes by sucking. My objection to the pump tests of fixtures is because of liability to injury from screwing the burner taps up so tightly.

Mr. Harbison—It has been our custom, for more than a quarter of a century, when pipes are first put in, to require two tests in every case—to try the tenacity of the pipes, and to carefully determine the lengths of various sizes of tubing used in the work. We think it important to determine this before the floors are laid. A property owner does not, of course, know anything about pipes which are concealed from his view. We require a second test to be made when the fixtures are put on. Our experience teaches us that this is necessary, since joiners are apt to injure the pipes after being put in. Sometimes we have found pipe seams open at the weld, and we have found couplings cracked by careless workmen after the pipes had been installed; and, were it not for the second test, we would very likely have results similar to those of the Boston experience detailed by our President. I doubt if anybody, having had anything like extended experience in the gas business, has escaped accidents of similar character. Where pipes are put into a building, and bricks put up about them, they are very liable to be injured. I remember an instance where a leak, starting in a partition, gas escaped up through two or three stories in the building; when a light was employed to search for the leak, the success of the hunt was such that we had to call on some masons and joiners to put pack the partitions again. I believe that has been the experience of most people. I think it is our duty, as gas men, to know that the fixtures and the piping are all in good condition before we turn on the gas. The public have a right to expect this of us, and we should try to not disappoint them.

Mr. Stedman—What is the usual remedy in case the owner of a building refuses to submit to an inspection?

The President—So far as the Boston Company is concerned, we will not supply the gas to a building unless the building has been tested.

Mr. Cabot—Do you mean after the chandeliers are placed?

The President—No; after the piping has been put in.

Mr. Harbison—That has always been our custom. We decline to set the meter until the fixtures have been tested. We tell the owners of the building that we make no charge for doing the work, but that we require it for self protection. We have had no difficulty in convincing them it was to their interest to have it done.

Mr. Nettleton—Does he think that Connecticut law will back him in refusing to supply the gas until the test has been made? As by our charter we are obliged to supply everyone, if an owner insists upon having gas in his building, do we not put it there at his risk, rather than at the risk of the company?

Mr. Harbison—I think Connecticut law would back us up, because the charters of the gas companies of Connecticut say that the boards of directors shall have power to make all necessary rules and regulations for the conduct of their business. I think there would be no difficulty in satisfying any court of justice that this requirement in regard to testing was very necessary, and in the interest of the consumer as well as of the company. I think Connecticut law would back us up in refusing to supply gas until a satisfactory test has been made; and I am very sure that the sentiment of the community, which gas companies always like to have with them as far as they can, would back us up in it without question.

Mr. Sherman—A few years ago the Providence (R. I.) Gas Company abandoned the supervision of the inside piping of houses. I would like to ask Mr. Slater, do the consumers suffer any inconvenience because of this lack of supervision?

Mr. Slater—So far as our experience goes, of the result of abandoning that system of pipe inspection in Providence, I think it has entailed more trouble and expense to the gas company than any other thing that ever happened. It leaves the matter open to competition between gas fitters; and the consumer, or the one who employs them to do the piping, will oftentimes, and in a majority of cases, unless they are thoroughly posted with regard to these things, take the lowest bidder; and the bidder, in order to protect himself against loss, will put in the smallest sizes of pipe he can, and will fail to do the work in a thorough manner. The result is that imperfect piping is a source of continual trouble and annoyance ever after. I think I am safe in saying that $2,000 per year would not pay the additional expense that our company has been put to, during the last few years, because of this imperfect fitting of the pipes.

Mr. Wood—I am glad to hear this testimony from our friend Slater. In New Bedford, Mass., we have got into the way of testing our pipes, also the fixtures; and I do not allow the gas to be turned on until they are thoroughly tried. I believe that the community are fully in sympathy with us in this regard. They understand that it is for their benefit; they expect it; consequently there is no trouble about it; and if there be any damage to the fixtures because of their being thus tested, we have yet to learn the fact. Still, such might be the case; but we are not aware of it. Reference was made in that paper to jointing with cement instead of lead. We have found that our system of testing the fixtures—not only of testing the pipes, but also the fixtures—prevents the gas fitters from using cement. They hardly use cement at all, except perhaps to fill their branches before they put them together. The jarring attending the finishing of a building will almost always start a leak in a pipe which has been stopped with cement. They have found that they have to take the pipes out again if they do leak, because they know that the gas will not be let on until the fixtures and pipes are both tight; and so they have stopped using cement, and now use lead almost entirely.

Mr. Allyn—In reference to the matter of testing fixtures, I should, from the experience I have had, agree with our friend Mr. Thomas, that it would be submitting fixtures to an unnecessary strain to place on them the extreme pressure which we apply to the pipes when putting them in. The plan adopted by the company with which I am connected is this: When the man who sets the meter gets ready to turn the gas on, he makes inquiry whether all the fixtures have been put in place. If they have been, he then turns on the gas, and waits ten or fifteen minutes, watching the indicator on the meter to see if it moves any. If he finds that it does move, the gas is shut off and report is made to the owner of the premises that there is a leak somewhere which must be found before the gas is turned on. If the fixtures are not on, we notify the parties that we leave the gas subject to their risk. If they turn it on, they must take the chance of any accident happening afterward.

Mr. Thomas—I have always followed that system. When a man goes to place a meter he is required to examine all the fixtures, and if the fixtures are not placed the meter is not set. When a job is to be tested the inspector goes through the house to see that everything is all tight. Then he gives the fitter a certificate that everything is in order. When the owner of the premises wants gas, he must bring back the certificate to the office in order to get his supply turned on. We have never had any trouble because of the course we take in refusing the gas until certain that everything is all right, because the people had to comply with the regulations of the company. The better way to put the piping in is with lead, and not with cement. The fitters often like to use cement, because it can be used to cover up a great many bad places; and they will sometimes cover up split pipes, or sand holes, in that way.

Mr. Harbison—An ounce of prevention is better than a pound of cure. I believe in beginning right, and I think that the plan of inspection when the

pipes are first put in, and then testing again after the fixtures are put on, and before the meter is set, is the only correct way. Mr. Thomas states that it is his custom to set the meter and then watch to see if there is any gas passing through it. According to that, it must be his custom to make both connections of the meter, which is not customary in all the places in New England. Our custom is to put in the inlet, but not the outlet, connection. We consider our duty performed when we have examined all the pipings and fittings, and have connected the fixtures with the meter from the inlet side. The plumber's duty is to put on the outlet connection. We like to know if the force-pump test is right; if it is, that is satisfactory evidence to us that everything is all right, and they can then turn on the gas when they have made the outlet connection. The system which has been in use in Williamsburgh, under the direction of Mr. Thomas, would seem, from his statement, to be different; and that it has not been the custom to put service pipes in a building until about the time they want to burn the gas. We have had pipes in buildings a year before they wanted to burn gas. Before they get the grading done they want to have the service pipes laid. Sometimes the owners of buildings are non-residents. It is not always the owner of the premises who is going to occupy them; and sometimes there is more than one family going into a building. We think the proper way is to have the fixtures tested first, and to have that done before there is any meter connected with the pipes. Then there are no contingencies connected with it thereafter, unless in the case of accident.

Mr. Nettleton—I must beg leave to differ with my good friend from Hartford in some respects. He says that he only connects the inlet pipe with the meter. The steps in which a house is piped are something like these: The piper puts in the piping at so much per foot, or for the job. It is tested, and he goes away; his work is done; the bill is brought in and paid by the owner. Then the gentleman who owns the house comes to the office of the gas company and wants his meter set. The gas company, according to Mr. Harbison's statements, go there and make an inlet connection. But perhaps the man wants his gas that night; then he has to hurry around and get a piper, who will charge him for time and material, and, in all probability, make an extravagant charge for a very small amount of work.

Mr. Harbison—He charges so much per job for the inlet connection; and we always charge for the outlet connection just so much.

Mr. Nettleton—It seems to me that the gas company is in a position to do that work very much cheaper than anyone else. So far as relates to my own company, I very strongly favor making all these expenses that add to the cost of burning gas as little as possible. In my own practice we set the meter and make the connection both on the inlet and on the outlet.

Mr. Allyn—I wish to say a word as to the gas company making one connection and the fitter the other. We had a rather unique experience in this respect a short time ago. There was an office in which gas had been used, I suppose, for 7 or 8 years, or perhaps even longer than that, and repeated complaints about low pressure had been made. Although only two burners were used, yet at times it was said not half enough pressure could be obtained. We changed the meters several times, and this seemed to make no difference. We sent an inspector instructed to make a final effort to discover, if possible, the cause of the pressure difficulty. He removed the connections and put on a three-light meter instead of the two-light meter which had been in use. When he took the first meter off he found that the gas fitter who had set it originally had forgotten to take the corks out; the cork on the inlet was still there, and all the gas that had been used had filtered through that cork. (Laughter.)

The President—I think the discussion just ended has shown the utility of papers similar to the one under examination. It has brought out the differences in customary practice in various States; and, further, has given us all opportunity for reflection on the subject, as to whether our individual methods in the matter of managing meters and testing pipes cannot be improved.

To go back to another subject, I will at this time appoint the sub-committees suggested in the recommendations of the Committee on President Slater's Address.

APPOINTMENT OF SPECIAL COMMITTEES.

On the committee to prepare suitable resolutions regarding the decease of Major G. Warren Dresser and Mr. William H. Price, the Chairman appointed Messrs. Hill, of Concord, N. H.; Stiness, of Pawtucket, R. I.; and Coggshall, of Fitchburg, Mass. The Chairman, continuing, said, I think the recommendations made by the committee, following out the ideas suggested by Mr. Slater in his address, are bound to be profitable. I will now appoint a committee for the purpose of presenting (before the next meeting—say, four months previous to that time) one or two questions which the members of the Association shall take into consideration, making such experiments in respect thereto, at their own works, as they conveniently can. If these problems are properly set before the members, I think that, at the next meeting, we ought to have some discussions, backed by figures, which will be of exceeding interest. The gentlemen to serve as such special committee are Messrs. Nettleton, Birmingham, Conn.; Stedman, of Newport, R. I.; and Rollins, of Worcester, Mass.

The next business in order is the reading of the second paper submitted in the prize competition—subsequently withdrawn, and now to be passed upon in the usual manner.

Mr. Stiness—Before that business is proceeded with I have been requested to make an announcement. Mr. Connelly, of Pittsburgh, Pa., has had a street governor placed in the office of Charles H. Sprague, in the Mason Building, adjoining the rooms of the Guild of Gas Managers; this instrument may be seen there in practical operation, and I have been requested to extend this invitation to members in order that those who wish to inspect the governor may know where it is to be found. I will further say that the rooms of the Guild of Gas Managers are open, and the members of the Association generally are invited to visit the rooms of the Guild, and partake of its hospitality.

Secretary Neal then read the paper, entitled

THE WEAKENING OF MAINS BY TAPPING.

It is probably the experience of all gas engineers that one of the most fruitful causes of leakage is broken mains; and that a large proportion of broken mains occur where they are tapped for a service pipe, or other purpose. While a pipe must be tapped, yet the great number of breaks at tapped holes would seem to indicate that, in some cases, the main was weakened too much, and weakened more than would be judged from mere superficial observation.

A main is usually broken from one of two causes—

1. Contraction, caused by reduction of temperature.

2. Settling of the earth at one or more places, causing the line of pipe to assume a form convex upward, or convex downward.

There are other causes of breaks, but they are due to peculiar circumstances, and form but small proportion of the total number.

In considering the case of stress caused by a change of temperature—suppose the pipe has to stand a variation of 30° between summer and winter. Probably many pipes in New England suffer a variation of temperature greater than this.

For instance, pipes laid near the mains of a steam heating company have a variation from nearly the temperature of high pressure steam, while the company is running, to 30° the next winter.

It has been proved by experiment on cast iron that a pull of 2,240 pounds will cause an inch of iron to stretch 1-5500 of its length; it is also true that an increase, or reduction, of 1° in temperature, causes an expansion or contraction of 1-162,000 of its length; combining these two facts, and it results that a contraction of the iron of 1-5500 of its length is produced by 29° reduction of temperature, consequently generating a pull of 2,240 pounds upon each square inch of iron in the cross section of the pipe. This being so, it is evident were the strength of the iron not sufficient to stand a pull of this amount per square inch, the size of the pipe would make no difference, a 12" main breaking as quickly as a 2".

The breaking load for cast iron, such as is usually put into gas mains, is given as 16,000 pounds per square inch. If pipes were calculated to stand just this amount of tension, a thousand circumstances might arise, any one of which, small in itself, would prove sufficient to break the pipe. Accordingly in all engineering work a factor of safety is used; that is, only a portion, say one-quarter or one-sixth of the total strength of the iron, is relied upon. Constant jarring and vibration, such as would be caused by heavy teaming over streets where pipes are buried, is considered very weakening to iron; and Anderson, in his "Strength of Materials," says structures subjected to this kind of stress should be loaded about 1 ton. Allowing, however, a factor of 6 the safe working load would be about 2,600 pounds per square inch. This would be the stress produced by a contraction in temperature of 34°. If, now, pipes are laid so near the surface that they are subjected to a change of temperature of more than 34°, a stress is put upon them which is not "safe," as engineers say.

The pull from change of temperature is capable of drawing a lead joint, and generally breaking a pipe before drawing a cement joint. In our experience we have had a case where a 3" wrought iron main, beneath a bridge, contracted enough to strip the thread and draw the end of the pipe to the very edge of the coupling.

According to these figures the pipes are "safe" for this reduction of temperature; but, in tapping, some of the iron is removed, leaving a smaller cross section to resist the same pull, and the more that is removed the greater the margin of safety is reduced.

The weakening of mains by tapping is shown in the following table, considering only the stress caused by change of temperature. This would show that 3-inch mains should not be tapped over 1 inch, or 4-inch mains over 1¼ inch, unless it is desired to run greater risks than are "safe" for 30° change of temperature.

Size.	Size Tapped.	Weakened.	Stress Increased from 2,240 pounds to—
2 inch.	¾ inch.	.16	2,598 pounds.
3 "	¾ "	.10	2,464 "
3 "	1 "	.13	2,521 "
3 "	1¼ "	.16	2,598 "
4 "	1 "	.10	2,464 "
4 "	1¼ "	.12	2,508 "
4 "	1½ "	.14	2,553 "
6 "	1 "	.06	2,374 "
6 "	1¼ "	.08	2,419 "
6 "	1½ "	.09	2,441 "
6 "	2 "	.10	2,464 "

While all do their utmost to have a solid bearing for the pipe, a great many cases of settling occur from poor work, heaving or settling of the ground, undermining for sewers, water pipes, etc. The pipe then being deprived of its support bends under the weight of the material above, till, reaching its limit of strength, it breaks.

When the pipe bends it is evident that the convex side grows longer, while the concave side grows shorter. This action causes the fibers of iron on the convex side to become extended, while those on the concave side become compressed; this extension and compression growing less and less till, at the central plane of the pipe, there is neither extension nor compression, and consequently no stress upon the iron at this place.

If there is no stress on this line, and the stress grows greater as we leave it, it is at once obvious that a pipe is weakened less by tapping here, on the center of the side of the pipe, than by tapping it anywhere else; and when it is tapped on top it is tapped at the point of greatest stress.

Yet, notwithstanding this, the usual practice is to tap on top, removing the very iron needed most to withstand the extension should the pipe be subjected to bending convex upward, or to withstand compression should the pipe bend convex downward.

The former only will be considered, as it is the common case and the most serious one, since cast iron is much stronger to withstand compression than extension.

For the privilege of tapping on top, and thus weakening the pipe as much as possible, the additional disadvantage is imposed of requiring the gas to flow around a bend, causing a less delivery of the gas by the service. It is true this is but a small amount; yet it is equally true that it is perfectly needless.

It will probably be argued that it is more convenient to tap on top. With proper tools it is doubtful if this is so; but, even if it were, if we prevent the breaking of one pipe in midwinter the inconvenience would be well repaid.

The load which a pipe may be subjected to cannot be calculated; but the resistance which a cross section of the pipe will oppose to breakage can be calculated and compared with cases where the cross section is reduced by cutting away a part, as in tapping. (See Rankine's Tables.)

By substituting various values for the size of pipe, and size of hole tapped, the following table is calculated:

Resistance to Cross Breaking.

Size.	Resistance.	Size.	Tapped on Top.	Resistance.	Weakened.
2 inches.	2,391 lbs.	.....	.....	.....	.....
3 "	4,973 "	3 inches.	½ inches.	4,238 lbs.	.15
		3 "	¾ "	4,001 "	.20
		3 "	1 "	3,767 "	.24
		3 "	1¼ "	3,514 "	.30
4 "	13,229 "	4 "	¾ "	11,288 "	.15
		4 "	1 "	10,816 "	.18
		4 "	1¼ "	10,344 "	.22
		4 "	1½ "	9,873 "	.26
6 "	28,681 "	6 "	1¼ "	24,446 "	.15
		6 "	1½ "	23,737 "	.17
		6 "	2 "	22,204 "	.22

Should the hole be tapped in the side, as before shown, the weakening is very small; but when tapped on top, one-fourth of the strength of the pipe is removed in the case of a 3-inch tapped 1 inch, or a 4-inch tapped 1½ inch, or a 6-inch tapped 2 inches; while a 3-inch tapped 1¼ inches shows a reduction in strength of nearly one-third.

To determine practically, as well as theoretically, the results of tapping, the following experiments were made upon a 3-inch cast iron main:

One end of a length of pipe was firmly fastened, allowing 10 feet to project; at the extreme end weights were applied. The weight of the pipe is also considered; it broke at 502 pounds.

A ¾-inch hole (*i. e.*, for ¾-inch pipe) was tapped on top, and, under the same conditions, the pipe broke at 381 pounds, showing a reduction in strength of nearly one-fourth.

A ¾-inch hole was tapped in the side, and the pipe was loaded to 475 pounds without breaking. Weights were taken off till there remained 360 pounds; the pipe was then turned gradually up, so that the hole on the side moved toward the top. Just before reaching it the pipe broke—breaking at 360 pounds. This clearly shows the benefit of tapping on the side, since it broke readily under 115 pounds less weight than was put upon it while the hole was in position on the side.

Another force which acts upon the pipe is that caused by forcing in the nipple or other fitting. The fitting, which is wedge shaped, is forced in by means of a screw, and this screw, driven by a lever in the form of a wrench. Here are all the elements for producing great power to thrust the iron apart.

A case was tried under the same conditions as before, except that a short nipple was forced in with a powerful wrench to make, if possible, an extreme case. Weights being applied, it broke at 215 pounds. Several days were allowed to elapse between forcing in the nipple and the testing, and about an inch of the break was found to be somewhat rusted, It undoubtedly was partially broken by forcing in the nipple.

A ¾-inch hole was tapped in the side, and the pipe loaded to 475 pounds without breaking, when, unfortunately, the irons binding the pipe in place gave way, lack of leisure afterward preventing further experiment. Enough, however, was done to verify the theory, and to prove that a hole tapped in the side weakened the pipe but a small amount, while one on top caused very serious weakening.

It is the practice in some places to tap a size smaller than the service run, connecting to the main with a reducing fitting; by this means the drilling and tapping is made easier, and the main, being cut away less, is weakened less. If this could be done without opposing too much resistance to the flow of gas through the service it would be considerable of an advantage.

To get at the resistance of the service itself, disregarding the resistance of the entrance to the service, Clegg's formula—

$$Q = 1{,}350\ d^{\frac{1}{2}} \sqrt{\frac{nd}{sl}}$$

—may be used. Transposing,

$$h = \frac{Q^2 sl}{1822500 d^5},$$

h being the resistance a service opposes to passing *Q* cubic feet of gas of *s* specific gravity, *d* being its diameter, and *l* its length in yards. By substituting various values for Q, d, and l, the resistance of any service can be calculated; or, in other words, the loss of pressure a service will cause in passing a certain amount of gas.

In calculating the resistance of a nipple or an elbow, if we disregard the extra friction caused by the bend, the case becomes different, since the resistance is not modified much by the length, nor will it discharge the quantity composed of its area multiplied by the velocity due to the pressure.

Its theoretical velocity would be $v = \sqrt{2gh}$, h being the height of a column of gas sufficient to cause the required pressure. To turn the expression into the usual form of inches of water, substitute for h, $\frac{p}{s}$, p being pressure of water in inches, and s the gravity of the gas as compared to water. This being its velocity, and the size of pipe being known, it seems as though their product would be the quantity discharged. It is found by experiment, however, that this is not so, but varies from .6 of this quantity, in the case of an orifice in a thin plate, to .95 in the case of the best nozzle; and for a short nipple it is about .8. So, to discharge a certain quantity, it would be necessary to increase this velocity one-fourth. Then the formula transposed, $p = \frac{v^2 s}{2g}$, would determine the resistance.

In the following table values have been calculated for services and nipples, and placed so that comparison can be made. For instance, a 1-inch service, 150 feet long, discharging 200 feet of gas an hour, opposes a resistance of .42 of an inch; while a ¾-inch short nipple, for the same quantity, is only .05; and, allowing the quantity disregarded in Clegg's formula as being small, .01 inch, the actual increase of resistance from using a size

smaller hole in the main is .04 inch. As the service grows in length the resistance of the pipe increases rapidly, while the nipple remains the same.

Services.				Nipples.		
Size.	Length.	Amount Gas.	Resistance.	Size.	Amount Gas.	Resistance.
Inches.	Feet.	Cubic Feet.		Inches.	Cubic Feet.	
¾	50	100	.16			
¾	75	100	.24	½	100	.06
¾	100	100	.32			
¾	150	100	.48			
¾	50	200	.64			
¾	75	200	.96	½	200	.23
¾	100	200	1.28			
¾	150	200	1.92	¾	100	.012
1	75	200	.21			
1	100	200	.28	¾	200	.048
1	150	200	.42			
1	75	300	.47			
1	100	300	.59			
1	150	300	.94	¾	300	.108
1¼	100	300	.21			
1¼	150	300	.31	1	200	.015
1¼	200	300	.42			
1¼	100	400	.37	1	300	.034
1¼	150	400	.55			
1¼	200	400	.74			
1½	150	500	.36			
1½	200	500	.48	1	400	.06
1½	250	500	.60			
1½	150	700	.71	1¼	400	.026
1½	200	700	.95	1¼	500	.04
1½	250	700	1.26	1¼	700	.08
2	200	700	.22			
2	300	700	.33	1½	500	.02
2	400	700	.44			
2	200	1,000	.44	1½	700	.04
2	300	1,000	.66			
2	400	1,000	.68	1½	1,000	.08
				2	1,000	.014

This shows that, in long services, a size smaller connection with the main may be used without having any appreciable effect on the supply, but with considerable advantage to the strength of the main. This would particularly apply to lamp-post and similar services.

If, then, it is wished to favor a main as much as possible—

1st. Mains should not be subjected to a change of temperature much over 30° without expansion joints.

2d. Mains of 3 inches should not be tapped over ¾ inch, nor 4 inch over 1¼ inch.

3d. Always tap on the side.

4th. Many cases occur where one size smaller connection with the main can be used to advantage, and, in some special cases, even two sizes smaller.

Discussion.

The President—We have had great pleasure in listening to this paper, which has value from being an account of actual experiment. I do not think the ideas suggested by its reading should be allowed to pass without discussion.

Mr. Slater—For a number of years it has been our rule to lay no 3-inch pipes for street mains. We, of course, do use such sizes for services. We never tap our 4-inch mains for anything over an inch. The author of the paper speaks about fractures as occurring generally where the mains are tapped; but I do not remember of such an occurrence happening to us during the last 10 years. Our breakages almost universally appear directly back of the bell.

Mr. Harbison—Is there any expansion joint that will not allow gas leaks?

Mr. Stiness—Yes.

Mr. Harbison—That question comes up in connection with the reading of the paper. If any gentleman present has had experience with expansion joints in street mains, I would like to hear the results of such investigation.

Mr. Stiness—On the bridges crossing our rivers (we have several such situations) we always use an expansion joint made in the form of a stuffing-box with asbestos packing. I have known these joints, as between winter and summer, to vary 3 inches. We have five rivers which we cross with wrought iron pipes. In some of these cases we employ a common lead sleeve, of from 6 to 8 inches in length. I think, however, that a regular stuffing-box, such as you would use on any steam pipe, is better. I am of the opinion that the thanks of the Association are due to the writer of the paper; and I understand that, to be fully appreciated, its figures must be carefully studied. In regard to an expansion joint I think it is entirely practicable to make such a joint as I have described work well in situations liable to vicissitudes of weather exposure. All that you want is a stuffing-box filled with asbestos packing; then you have a connection as perfect as any steam joint. We scarcely ever use 3-inch pipes, and never drill into those over a ¼-tap. So far as I remember, we never had a pipe to break at the point of tapping.

Mr. Harbison—I did not suppose an expansion joint could not be made which would be gas tight; still there is room for question as to the practicability of such joints in connection with pipes buried beneath the earth's surface. In this event the making of an expansion joint is attended with greater difficulty than in the case of a pipe crossing a river or bridge, where pipes would be exposed and accessible. In some parts of New England frost goes down to a depth of 4 feet, and even more; and there is a variation of more than 30° in temperature between the frozen ground and summer heat. Whether the expansion joint alluded to by Mr. Stiness would be practicable underground is the question. I do not know whether the author of the paper would recommend, or deem advisable, the employment of an expansion joint in the case of a pipe 300 or 400 feet in length. This is one of the questions that must come up wherever there is any great variation in temperature. The writer of the paper alludes to the effect of steam pipes upon gas pipes—one winter as compared with another. This assumes that the steam company had gone out of existence between one winter and the next. In Hartford we have had some experience in connection with the laying of steam-heating mains. We had a case where a 4-inch cast-iron service pipe was carried into a block; the steam company, in laying its pipe, approached so closely to our 4-inch service as to cause it to convey the heat from the steam pipes into the cellar of the building supplied by us with gas—indeed, at a distance of 12 inches from inside the cellar wall, that service pipe was so hot you could not place your hand on it. You may well imagine the temperature of the gas supplied to that building, and we had great trouble with the fittings, fixtures, and meters in consequence. It was nearer to a carrying out of the water gas process than any experience we have had before or since.

Mr. Allyn—I have had some experience in using expansion joints on bridges, and, in our practice, they have worked nicely; still I should doubt the utility of putting them underground, unless the mains were laid in culverts. Certainly, if the ground were frozen sufficiently hard as to make it at all dangerous to the safety of the main, the resistance of joints would be so great that expansion joints would not amount to anything. It goes without saying that mains are necessarily more or less weakened by tapping, be the size of the taps what they may; yet I can hardly remember an instance where I have had a main fractured at the tapping point. The breaks have been invariably found at the back of the bell—just as was stated by Mr. Slater.

Mr. Sherman—Perhaps Mr. Nettleton will give us the benefit of his experience in this respect. I think he has used an expansion joint recommended by Mr. William Farmer, of New York.

Mr. Nettleton—The joint referred to by Mr. Sherman can hardly be called an expansion joint. I was advised by Mr. Farmer, preparatory to laying a pipe across a bridge (as the cost of wrought-iron pipe was so great, and as he knew of no perfectly tight expansion joints) to put in, about every four or five lengths, a pipe which had been turned down perfectly smooth for about 8 inches on the spigot end. The bridge on which this pipe was used was, perhaps, 500 feet long, and about ten lengths were distributed along the line

of pipe. The result was that, in extreme heat or in extreme cold, the expansion or contraction of the pipe would cause the smooth joint to slip a trifle in the lead. In winter the contraction of the pipe would cause the joint to draw out a little, and, in summer, to push back. I have used this joint for four or five years, and it works very well.

Mr. Harbison—Do you find any leaks in these slip-joints?

Mr. Nettleton—About three times a year the pipe is examined; occasionally leaks are found, but these are usually trifling, and very few. The pipe is practically tight.

Mr. Cabot—We have had some experience with these joints in our river crossings, and have a wrought-iron pipe, 6 inches in diameter, 700 or 800 feet in length, fitted with expansion joints. We have two pipes on one bridge, and one on another. These pipes are carefully watched, and we have never yet discovered a leak. In regard to expansion joints, I should think that the bell of the pipe would hold it so rigidly in the ground as to make the expansion small. A further objection is the expense. Chimneys would have to be constructed at short distances, so that the joints might be easily gotten at. In some clayey soils I hardly think much expansion would be experienced. We seldom find a pipe broken except back of the bell. We have found great benefit, when mains were laid in clayey soil, or in any soil likely to pack exceptionally hard in winter, in placing sand about the mains when bedding them. This appears to materially relieve straining tendencies.

The President—I would say, in regard to our experience as shown in Boston, that we have had several bad breaks occasioned in the way described by the author of the paper. The pipes had broken at places where taps had been made, and we have had several suits arising out of these very fractures. Probably it is known that we have here in Boston, for many years, been in the habit of using cement joints; and we still adhere to this practice of using cement joints in all pipes which are laid down in old ground. Having, of late years, had so many pipe fractures in sections of the city where the soil consisted largely of filling, we adopted the practice of inserting a leaden joint at short intervals, the intervening joints consisting of cement; the idea being to allow the pipe a chance to pull a little, in case the ground "heaved" during the spring season. The leaden joints have given us no trouble from fractures, but several of the cemented ones have given rise to serious leaks.

Mr. Cabot—You speak of these leaden joints as being only occasionally laid. On that account do you not find that they require frequent driving up?

The President—I suppose that necessity for so doing may happen some time; still we have not had occasion to do so in three year's time.

Mr. Harbison—I think the members ought to understand that the "sad experience," gained through the breaking of mains directly back of the bell, in most cases, is found only where cement joints are exclusively used.

The President—I have no doubt of that.

Mr. Harbison—In my experience, where using lead joints alone, I have never had a main break back of the bell.

On motion of Mr. Stiness, a vote of thanks was tendered to the author of the paper, discussion on which was terminated.

[To be continued.]

A Suggestion Concerning the Patent Gas Man.

By Frederic Egner.

Without decrying the merits of inventors and their useful work, yet the indiscriminate granting of patents paves the way for deception and fraud; and it would seem to be nearly time that gas companies should, in their own interests, seriously consider the matter, and act as one body for common protection.

From January 1 up to, and including, March 11, 1884, no less than nineteen patents were granted, by the United States Patent Office, for processes of making gas. A proportionate number were issued in the year 1883; and, judging from the similarity of the majority of claims, there is no limit to this business.

Though many readers of this Journal are acquainted with the matter about to be described, the following may yet be of interest to others. When an application for a patent is made to the Patent Office, the drawings required usually do not only contain that particular invention for which protection by patent is asked, but they include—sometimes necessarily—a representation of the apparatus in connection with which the invention is to be operated. From an examination of the claims accompanying the specifications of the patent, it will frequently be found that the invention proper is mentioned, surrounded by other matter, in such a way, as to make the whole seem to be part and parcel of one thing. The best way to illustrate this is by giving the "claims" of two patents issued seventeen years apart, but both within the past eighteen years.

Claims of the early patent, now void: First claim—The manufacture of gas for lighting or heating purposes from pulverized or fine coal, or other carbonaceous materials, injected into retorts or ovens in small quantities, either by separate successive injections, or, in small continuous currents, as herein described.

Second claim—The injection into retorts, or suitable ovens or chambers, of pulverized, powdered, or small coal, sawdust, oils, or carbonaceous materials, by means of steam supplied to such retorts in separate charges or in continuous currents, as herein described.

Third claim—The injection of suitable carbonaceous materials, as aforesaid, for the manufacture of gas, into retorts, ovens, or heated chambers by separate successive injections, or currents, by means of compressed atmospheric air, compressed gas, springs, or other mechanical means, as hereinbefore described, whether the interiors of such retorts be under a slight degree of pressure or vacuum.

The making of gas by the decomposition of steam in contact with heated carbon is described in the specification of this patent as part of its operation; but it is not claimed as part of the invention—the inventor well knowing (even eighteen years ago) that he could not claim the making of water gas—the latter having been manufactured on a large scale during an experiment, under the supervision of competent engineers, in Brooklyn, New York, fully twelve years before this patent was applied for. But, not to take up too much of your space, instead of giving the full text of the "claim" of the later patent, the first claim of the eight of this patent is given, viz.: First claim—The process of producing illuminating gas, which consists in, first, generating heating gas, composed of hydrogen and carbonic oxide, forcing such gas, under pressure, into an injecting device, and thereby spraying hydrocarbon liquid into a vaporizing apparatus, conducting the commingled gas and vapor through the heated vaporizer, and then combining and fixing the mixture in heated retorts.

Bear in mind that the making of hydrogen and carbonic oxide cannot be claimed as an invention of the last patentee; and then compare the rest with the claims of the lapsed patent first quoted. Even though the first patent had never existed, the last is such a clear infringement of a well known New York water gas process (which is itself for the most part an infringement) that its operation would never be tolerated by the owners of the New York process mentioned. And yet a patent was granted. A construction company may be formed; and moneyed men deceived into buying stock, and non-practical directors of gas companies bulldozed into compromises with the patent gas man, who, armed with a copy of the drawings and specifications of his apparatus, showing a complete process surrounding the very likely quite dispensable improvement which he has invented, is able to worry many not too well posted in such matters.

As a possible remedy the following is suggested: The gas companies of the United States, as a body, could easily subscribe a certain amount annually, sufficiently large to pay a respectable salary to an experienced practical gas engineer, whose duty it should be to inspect and investigate all patents in apparatus for making illuminating gas, as soon as such patents could be got at, and to report to the subscribing companies the results of such investigation. Should it be found that any patent is merely a revamping or revivification of an obsolete one, this engineer might take prompt action at the Patent Office; and by this means the flood of meaningless, but still troublesome, patents be choked. While if an invention of real merit were patented, the subscribers would be promptly informed of it, and could act and govern themselves accordingly. The expense to the gas companies—of carrying out this suggestion—would be small, provided all would act together, and the benefits would certainly be worth the money expended.

The examples quoted in this paper were taken at random; but the writer could quote dozens of patent issues which are not worth the paper they are printed upon, and yet some of which have been the means of the loss of hundreds of thousands of dollars to single companies, and millions of dollars, in the aggregate, to the legitimate gas companies throughout the land.

Notes on Purification.

[At the Thirteenth Half-Yearly Meeting of the Southwest of England District Association of Gas Managers, held at Salisbury, England, on March 11th, Mr. Thomas Hardick presiding, the following paper on the above subject was read by the author, Mr. J. W. Helps, of Weston-super-Mare. Our report of same is taken from the London *Journal*.]

In presenting to the Association these few notes on lime and oxide purification, I do not pretend to advance any new methods or discoveries, as no doubt the means I have adopted for freeing the gas from sulphuretted hydrogen, carbonic acid, etc., are similar to those in vogue amongst many present. My main object is to simply provoke such a discussion (no doubt from partly a selfish motive) as will elicit information respecting the most economical and effective manner of obtaining good results. I may at once say that at Weston we are not under any restrictions as to the amount of sulphur permissible in the gas; but during the past two or three years I have made frequent trials with Mr. Vernon Harcourt's color test, and have found a diffi-

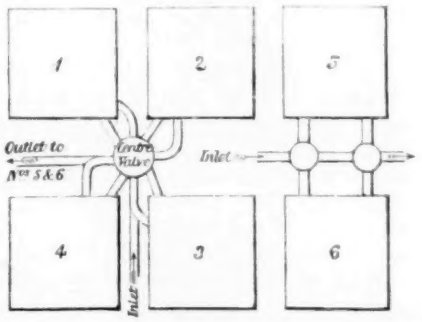
culty in obtaining the desirable (or rather the undesirable) tint, which I presume proves that at any rate no more than 12 or 15 grains of sulphur impurities per 100 cubic feet are present. At the meeting of the Gas Institute last year Mr. F. Livesey read a paper in which he described five methods of carrying out the required purification; but I venture to say that, with the exception of the last (four purifiers all charged with lime), none were exactly suitable for small and medium-sized works, as not less than eight or ten purifiers were necessary to work them.

Until the beginning of last year we had at Weston worked a series of four purifiers, all 15 feet square inside diameter, by means of a center valve; having always three on and one off. Each contained lime produced from 6½ tons of unslaked material. Just before the presence of sulphuretted hydrogen was noticed at the outlet of the third purifier, the fourth box was put on, and so on. Naturally the spent lime, being highly charged with sulphuretted hydrogen, came out in a very objectionable condition; and in a watering-place such as Weston-super-Mare it is unnecessary to remark that disagreeable odors are to be most carefully guarded against. I should also add that we have difficulty in getting rid of the spent material, even when it is given away. With this process there was very little chance of a purifier coming off unawares, as the boxes required changing in very fair regularity. During the year 1882, 27 boxes were charged, and 172 tons of lime used, which gives 284,000 cubic feet purified per ton of lime.

Boxes Changed in 1882.

January	4	July	1
February	2	August	2
March	1	September	3
April	2	October	3
May	1	November	2
June	1	December	5

Early last year two other purifiers of a similar size were completed and put into action, and worked independently of the first series, by means of two four-way valves. These were charged with lime; and as the lime in the old boxes became foul, oxide was substituted. The first oxide was used on February 22, 1883, and this remained in work until August 27; two other oxide boxes having come into use in the interim. But I now found that the lime in the two new purifiers, when eliminating carbonic acid only, came off nearly as quickly as when the lime was doing the whole duty, and the fourth purifier was not in turn charged with oxide, but filled with two 7-inch layers of lime in the bottom tiers, and a 15-inch layer of oxide on the top; and so



this method was adopted with the other boxes. The plan seemed to work very well for a time, and we saved some amount of lime; but soon the manner in which the purifiers fouled became very erratic, both as regards lime and oxide. For instance the lime in box No. 5 lasted more than two months, but on No. 6 being put into use it showed carbonic acid in three days. This perhaps was partly due to the material having dried somewhat while the box was standing off; though this could not have happened to any great extent, as the cover was kept down, and consequently air-tight.

Boxes Changed in 1883.

Old Boxes.		New Boxes.	
January	3, all lime.	March	2, lime.
February	1, "	April	2, "
"	2, all oxide.	May	3, "
March	1, "	June	1, "
May	1, half oxide, half lime.	July	1, "
August	1, " "	August	2, "
October	2, " "	September	2, "
November	3, " "	October	1, "
December	1, " "	November	0, "
		December	2, "

However, I continued this arrangement for some little time, and should probably have been still working as described had it not been for the following circumstance. In the first week of the present year sulphuretted hydrogen showed itself near the outlet of No. 2, and No. 3 (which was ready charged with oxide) was turned on, and of course gave a clean test at the outlet. However, during the evening of the same day I detected a familiar yet strange odor in the gas when turned on, which proved to me the presence of sulphuretted hydrogen. On going to the works I made careful tests, and found that although no sulphuretted hydrogen showed itself at the outlet of No. 3, yet when the gas was tried at the outlet of No. 6 the lead paper was quickly blackened. Now I considered this strange, as I was not aware that any sulphuretted hydrogen had passed into these two latter boxes, which were both filled with lime; but the result plainly showed me that such was the case. I therefore concluded that the layers of lime in boxes Nos. 1, 2, and 4 having become saturated with carbonic acid, impurity was passing into Nos. 5 and 6, and liberating sulphuretted hydrogen, which was carried away with the gas into the holders. As quickly as possible I changed No. 4, and filled it with lime, which by arresting carbonic acid, stopped the liberation of sulphuretted hydrogen from Nos. 5 and 6.

No doubt the most of you know the strange power possessed (and occasionally exercised) by an oxide purifier, of appearing clean one day, foul the next, and giving a clean test with lead paper on the third. When I was engaged at Leeds, under Mr. Henry Woodall, I had to make daily tests for sulphur. When oxide only was being used, we occasionally found the quantity of sulphur compounds rise from (say) 30 grains to 50 grains per 100 cubic feet in 24 hours, and as suddenly drop again to its normal amount. In some such similar manner, no doubt, our lime purifiers had received the sulphuretted hydrogen which the oxide boxes had set free. We without delay, and as quickly as possible, changed all the oxide in the first series and substituted lime, and filled the last two purifiers (Nos. 5 and 6) with oxide. So far I believe this to be the safest, best, and most economical method, as there is no need to change a lime purifier immediately the presence of sulphuretted hydrogen is noticed at the outlet; for, as is well known, the lime will continue for a great length of time afterward to do useful work in eliminating carbonic acid and the sulphur compounds, and I find that the spent lime, when taken out, is far less objectionable the longer it remains, as the sulphuretted hydrogen is driven forward by the carbonic acid. I do not quite know whether the lime in the second and third boxes will have time to take up bisulphide of carbon before the carbonic acid arrives; but from the red appearance of the bottom layer of lime which was removed from the last purifier emptied at our works, I should certainly say it will, and both this and the blood-red liquor which contains the soluble portions of the lime carried down by the condensed aqueous vapors may yet be found to have a high commercial value, if the studies and researches of Mr. Leicester Greville and others on this subject should be as successful as they deserve. The sulphuretted hydrogen passes on into the oxide catch-boxes, where it is arrested. As soon as it shows itself at the outlet of the first (No. 5), this one is turned off; and when it in turn shows at the end of the second (No. 6), we put on No. 1 (lime) in the first series—that is if carbonic acid is getting dangerous; and I have hopes that by this means we shall effect an economy in both material and labor, and also effectually carry out the required purification. I have not tried it long enough to speak positively, and shall be glad if others who have tried, or are trying, a similar plan will give us the benefit of their experience. I shall also be glad to know if any present have successfully adopted means for revivifying the oxide *in situ*, as I feel confident that if this can be done economically one great difficulty will be removed.

To give a comparative statement of the cost of the two last years' working will not, I fear, be of much service; but I give it below, as it may assist in the discussion. I have calculated that to empty and recharge a lime box, including the cost of slaking, amounts to 50s.; while to empty and recharge an oxide box, including the revivifying of material, cost in labor 60s. In 1882 we used 172 tons of lime in 27 changes—

27 changes, at 50s. each	£67	10	0
172 tons of lime, at 9s. per ton	77	8	0
Total	£144	18	0

Gas made, 48,900,000 cubic feet; total cost, 0.71d. per 1,000 cu. ft.

In 1883 we had—

23½ lime changes, at 50s. each	£58	15	0
7½ oxide changes at 60s. each	22	10	0
152 tons of lime, at 9s. per ton	68	8	0
Total	£149	13	0

Gas made, 49,270,000 cubic feet; total cost, 0.72d. per 1,000 cu. ft.

I have not charged anything for cost of oxide, for I am confident we can sell this, when saturated with sulphur, at a price which will repay our first outlay. Indeed, when purchasing, I was offered the whole material free, on condition that we should return the oxide to the sellers when spent. I am aware that our charges for labor are very high. This is accounted for in several ways. We have a rather slow method of conveying the lime and oxide from the ground to the high level of the purifiers. Then the work is

done at odd times by three of the lamplighters; and it is difficult to calculate the exact time taken, which must naturally be more than if the work were completed straight off. Again, the spent lime has also to be conveyed to a distance of more than 100 yards over rough ground; and up to the present time our revivifying space has been far too small.

Discussion.

Mr. C. S. Ellery (Bath) said the meeting had just heard a very interesting paper. In regard to the cost of labor in connection with purifying, he might, perhaps, be weak on contract work in gas works; but he would suggest that a most interesting subject for inquiry would be the comparative cost of day work and contract work in getting the material in and out of the purifiers. Of course, when the works were large enough to admit of a gang of men being kept regularly at the purifiers, with no other work to do, it could be performed to much greater advantage; but in Mr. Helps' case he believed the work was done at odd times by men having other duties to attend to Another subject that might be considered with profit was the relative cost of lime and oxide for purifying. In connection with purification by means of oxide of iron, Mr. Helps had not mentioned the age of his material. It was well known that when oxide had been used about twice it would do more work than when it had only been used once, on the one hand, or seven or eight times on the other; so he should be glad to know if the experiences in question were with new or old material. Another important thing was the revivification—the manner of treating, and the time allowed; as, if the material was not thoroughly restored to an active condition before being put into the purifier, it would not last so long as it should. Some time ago it was suggested to him that the oxide, on being thrown out of the purifiers, should be allowed to remain in a heap for 24 hours, instead of being spread as soon as possible. He tried the experiment with some trepidation, apprehending that it might heat to an undesirable extent; but the heap gave no indications of heating, and it revivified as much while left in the heap as it used to do when spread. For many years he had a strong prejudice against oxide of iron, believing that it would not pay; but he must now admit the desirability of using it. There were difficulties in working lime and oxide in one purifier. If the lime was put at the bottom and the oxide at the top, some of the oxide would fall through on to the lime, and be thrown away with it. On the other hand the lime would drop into the oxide. When the lime was saturated with sulphuretted hydrogen, it was in a proper condition to take up the sulphur compounds; but if gas containing carbonic acid were allowed to reach it, the carbonic acid would displace the sulphuretted hydrogen, and cause it to be driven forward. He would not, however, venture to speak on the chemical part of the subject, as there was then an eminent chemist in the room.

The President suggested that the meeting would be glad to hear some remarks from Mr. Farrand as to the purifying operations at the Ryde Gas Works; for it was, he said, generally known that there were no works where the purification was carried on in a more efficient manner.

Mr. F. F. Farrand (Ryde) said that at Ryde they had five purifiers, two being 25 feet by 20 feet, and three 12 feet square. Each purifier was charged with one layer of material only, but this was 4½ feet in thickness. Four purifiers were charged with oxide, and one—the last in the series—with lime. The latter contained 4½ tons of lime. He was very particular in having the material pressed and well trodden down all round the sides of the purifier, and also round the emptying column in the center. During the last six months he had changed one lime and four oxide purifiers; and only one purifier had been changed this year. The oxide he had in use at present had been employed for four years. One purifier—the first in the series—had been in use for twelve months without changing or turning off. The sulphur in the gas averaged 12.2 grains; the carbonic acid was really nothing beyond the merest trace; and the cost of purification worked out to 0.08d. per 1,000 cubic feet. His practice with regard to revivification was to allow the oxide to remain in a heap, as thrown out of the purifier, for four days, so as to get hot (he did not mind how hot it became); and, when spread, it revivified in about 15 hours.

Mr. W. W. Monk (Bournemouth) said he had found that the best plan was to allow the oxide to stand in a heap after being thrown out of the purifier. It revivified much quicker.

Mr. S. W. Durkin (Southampton) remarked that Mr. Helps had asked for some opinion as to the cause of the sulphuretted hydrogen stain at the outlet of the clean purifier. Some years since he was troubled in the same way on several occasions, and at that time was using lime at the bottom of each purifier, with oxide above it. He found that the lead paper assumed the peculiar hue indicative of the presence of sulphuretted hydrogen at the outlet of the last purifier, although the last but one gave quite a clean test. It was not a pronounced black stain, only a faint brown one. He made a series of tests, and obtained this strange result on several occasions. In consequence the oxide and lime was all turned out; and lime only used for a long time. In the meantime the oxide was allowed to remain in a heap for at least 24 hours after being thrown out of the purifiers, before being spread out in the usual manner; and when used again the oxide was found to be efficient. Since that time he had read up every possible thing he could get hold of to account for the faint stain, and had mentioned the matter to several gas chemists; but he had not been able to obtain any information as to the cause. He did not now use lime in the oxide boxes, having last summer erected three additional purifiers for lime. Two of these were for the carbonic acid, and one for the sulphur compounds. The other purifiers were charged with oxide, and about 11 or 12 million cubic feet of gas were passed through each charge. Since making this change he had not experienced any trouble.

Mr. H. Sainsbury (Trowbridge) said that some two years ago, having put down some large purifiers, he gave increased attention to the purity of his gas, and used a continuous test in his photometer-room. Although the gas appeared quite pure to the test applied in the ordinary manner, if the lead paper was allowed to remain in contact with the gas for 24 hours it became dirty. He then took long tests at the lime purifiers; and found that although the lead paper would remain clean after five minutes' exposure, in ten minutes it would be discolored. After careful examination, it was discovered that the valves leaked slightly. Having carefully cleaned and adjusted the valves, he was able to get a clean paper with the continuous test. This little piece of experience might throw some light on the cause of Mr. Helps's difficulties. When using new oxide with his large purifiers, he found it would not revivify at first so rapidly as after a certain amount of usage. After a second time of using, he had to let it remain two or three weeks. He should do better work with it the second two years than during the first two years it was in use.

Mr. Ellery expressed a wish to know what quantity of sulphur was present in the oxide after four years' use at Ryde. He remarked that perhaps a large quantity of oxide was used to purify a small quantity of gas.

Mr. Garnett said his oxide contained 52 per cent of sulphur.

Mr. W. A. Padfield (Exeter) inquired whether Mr. Helps had noticed any difference in the illuminating power of his gas during his experiences.

Mr. Helps, in replying, said that Mr. Ellery had referred to the cost for labor; and he must say that he felt ashamed of these figures. They were, however, scarcely to be taken as a true gauge. His purifying work was done by the lamplighters, whose hours at the works were from nine to three; but as they did not put the time together very carefully, time might possibly be debited to "purifiers" that should not be so charged. They also had to carry the material upstairs, as he had mentioned. He started with oxide quite new; and on testing it last week, after it had been used three or four times, he found that it contained 34.5 per cent. of sulphur. It was not particularly the oxide that he complained about. It was carbonic acid he was dealing with; for he supplied gas of 17-candle power, and was sure it was cheaper to take out the carbonic acid than to put illuminating power into the gas. Mr. Farrand said that one box of lime, containing 4½ tons, lasted six months. It could not possibly take out anything like all the carbonic acid during this length of time. If the lime purifier was not changed oftener than this, it was scarcely worth while to trouble to use lime at all. With regard to Mr. Durkin's remarks, unfortunately it was not in his case merely a fine stain on the test paper. Like Mr. Sainsbury, he had found that some of his valves were leaky; but this was not his principal difficulty, which arose from the rush of sulphuretted hydrogen, caused by the displacing action of carbonic acid, and also in some part, he thought, to sulphuretted hydrogen given off by the oxide. Mr. Padfield asked whether the use of six purifiers instead of four had any effect on the illuminating power. He remembered that Mr. Leicester Greville had stated, in the *Journal of Gas Lighting*, that solid material had the effect of deteriorating illuminating power. However, he had not observed such an effect. His gas was thoroughly well washed, as it passed through two scrubbers—one packed with boards, the other with coke—and a washer-scrubber. It never contained even a trace of ammonia at the inlet of the purifiers. In conclusion, he was much obliged to those who had given him information (especially as regarded revivification) on the subjects referred to in his paper.

Report of the Board of Public Interests on the Richmond (Va.) Gas Works.

We had hoped to be able to give an extended synopsis of the report of the Board of Public Interests, made to the City Council of Richmond, Va., on cost, condition, etc., of the gas plant owned and operated by the city. The report contains so much matter uninteresting to those not intimately connected with, and informed of, what is being done at this immediate place that we will but republish the summary of conclusions reached and recommended. These were—

1st. That the gas works be placed under charge of a competent engineer.

2d. That the manufacturing facilities at the lower works be improved by

the addition of a new scrubber and new condensers, and by such changes in the retort house as are suggested by Captain Benson's report.

3d. The purchase of a Bunsen bar photometer for measuring the candle power of the gas.

4th. That the facilities for the distribution of gas be improved by laying new mains in the manner indicated in the accompanying report of Captain Frederick S. Benson.

5th. That after these improvements are made, the use of a 4-foot burner on our street lamps.

6th. That each department of the city government shall have placed to its credit a sum to be used for paying for gas, and that bills shall be presented and collected monthly, as is done with private consumers.

It is the custom in many cities to change and test the meters once in three years. We would suggest that some similar regulations be adopted by our department.

Captain Benson's opinion is then appended, and his recommendations relate solely to common sense and sound suggestions looking to proper main extensions, which, from all that we can learn, are absolutely necessary to the correct supply-service of Richmond's gas consumers. Why the Board should recommend that the gas works be placed under the charge of a competent engineer we fail to see. If the present office of superintendent is to be abolished, and the position of engineer is to be created, it would seem as though the City Council would not have far to look to find a gentleman in every way qualified to fill the bill. All that need be done is to promote, if there is any promotion in altering a title, the man who has faithfully and efficiently served the Richmond gas interests for many years. There is another necessity; when Mr. Knowles is made engineer, give him the power to do what he knows is needed, and let him not be hampered by the actions of the evident amateurs now seeking to meddle with and muddle the gas supply of the city. Naturally enough, Mr. Knowles does not like the slight upon him, and frees his mind in the following manner:

"OFFICE SUPERINTENDENT OF CITY GAS WORKS,
RICHMOND, VA., March 26th, 1884.

"To the Citizens of Richmond:—The subscriber reluctantly appears before you in this capacity, but after the remarkable report of the Board of Public Interests recently laid before the Council he deems an explanation due to himself as well as to the public. Without entering into detail, it may be stated in general terms that this is the first time within an experience of some thirty years or more with the gas works, fourteen of which have been as superintendent, that it has been stated a gas engineer is essential to the proper manufacture of gas and its effectual distribution. We have in Richmond works of as durable and as perfect a character as could be expected from the length of time they have been in existence, and the limited amounts that have been expended in their repair and added apparatus.

"The remark of the Board of Public Interests that great changes have taken place in the past few years in the economical manufacture of coal gas, and that they think our works should be under the management of a skilled and competent gas engineer, who would at all times keep well informed of the best methods of gas manufacture, and be able to produce the best results with the least expenditure of money, is merely the opinion of these gentlemen, wholly without experience, and who cannot possibly have had opportunities equal to mine. This I assert without egotism or a disposition to arrogate to myself a superior knowledge to some who claim to be gas engineers. Of one thing, however, I feel assured; for fourteen years past I have made it a constant study to keep myself thoroughly informed as to all the details of the manufacture of gas, and there has been no economy suggested by others or that has occurred to myself as the result of close observation and experience which has not been availed of, and that to advantage.

"The deficiency of gas, about which so much has been said, and which I complained to our worthy Mayor more than a year ago, has been a fact so apparent that it did not admit of debate. I urged that the street mains were altogether inadequate years ago; that they were laid twenty or thirty years ago for a population of 40,000, and that it was simply an impossibility that they could now meet the demand made upon them by 70,000 or more persons. That there have been occasional defects, and sometimes accidents at the works, I concede, but I submit that could the records of the gas works of the whole country be examined it would be ascertained that the Richmond works have been as free from just cause of complaint, if not more so, than others. The inadequacy of the works is a matter for which I do not hold myself justly blamable.

"It is within the recollection of all of the members of the Council and of the community generally that after the constant wear and tear of thirty years' service it was with the greatest difficulty that the Committee on Light, at my suggestion, succeeded in procuring an appropriation of $25,000. This, however, did not include enlarged street-mains. Without trying the patience of the public I would ask, in conclusion, what more has the expert, Captain Benson, urged than had been urged time and again by myself? Read his report carefully, and it will be seen that he has simply recommended an enlargement and an extension of the street-mains.

"For fourteen years I have been connected with these works as its superintendent. With a clear conscience I can say that I have devoted the best years of my life and given my undivided attention to their care and their management.

"My annual reports have exhibited to the people economical management, a full supply of gas to all the public offices and public buildings of the city (extravagant as has been its use, according to the Board of Public Interests' report), and then earned for the payment of the city's expenses thousands of dollars. For many years I have done this at a salary far less than that received by any superintendent of similar or works of much less magnitude in any portion of the United States. The thanks I receive is a recommendation that the office of superintendent be abolished and that the position of gas engineer be created.

"I appeal to the people and ask them to stand by a long-tried public servant. With them is the source of all power, and by their decision I will stand or fall. Very respectfully, JOHN H. KNOWLES, Superintendent."

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

PERSONAL—FRANCIS H. JACKSON.—A change has been made in the Executive officers of the Westmoreland Coal Company. On April 1, Mr. Edward C. Biddle resigned the chairmanship of the company, and at the meeting, held Thursday, April 3, to fill the vacancy created, Mr. Francis H. Jackson, formerly Vice-President and Treasurer, was promoted to the Presidency, and Mr. Edmund H. McCullough, for years past Assistant Treasurer and Secretary, was made Secretary and Treasurer. To Mr. Jackson, we believe, more than any other official connected with the Westmoreland Coal Company, is the continued success of the corporation due. Noted as it always has been for fair and honest dealing with all its customers, we most heartily congratulate Mr. Jackson on his elevation to the chairmanship of the company that he has so long and faithfully served.

GAS MATTERS AT MUNCIE, IND.—Mr. S. M. Highlands, the energetic superintendent of the Muncie (Ind.) Gas Works, says that in view of all the reports sent into the JOURNAL office about cheap gas, he would like to make some mention of what is being done in that respect in his locality. Muncie possesses a population of about 6,000, and the Muncie Company has 400 consumers' meters set, also supplying gas to 100 street lamps. The price charged for gas is $1.80 per 1,000, and the Muncie folks report that it pays, even in the West, to sell gas at low figures. Mr. Highlands, who is a member of the firm of Kuhn & Co., which firm owns the Muncie Gas Works, further says: "We have another gas plant, about 40 miles from here, where we charge $2.50 per 1,000. The towns are about the same size; but we find we can sell three times as much gas at the $1.80 price when comparing the output with the locality where we charge $2.50; although, as yet, we are not fully satisfied which pays the better." It strikes us that Muncie would be a good place for "wreckers" to keep away from; and think that Mr. Highlands will not long remain in doubt as to the better policy to be pursued.

PERSONAL—BENJAMIN RANKIN.—Mr. Benjamin Rankin's connection with the Louisville (Ky.) Gas Light Company was terminated on the 3d of April. He had been in its service upwards of thirty years.

ANNUAL MEETING OF THE AMERICAN WATER WORKS ASSOCIATION.—The Fourth Annual Meeting of the American Water Works Association was convened yesterday, April 15, at Melodeon Hall, Cincinnati, Ohio. The sessions will continue to-day and to-morrow. An excellent programme has been provided, including among its features the reading of 13 papers, and excursions to various points of interest in and about Cincinnati. Mr. J. G. Briggs is President, and J. H. Decker, of Hannibal, Mo., Secretary and Treasurer of the Association. Mr. Decker is well known to the gas fraternity of the United States as the wideawake Superintendent of the Hannibal (Mo.) Gas Light Company, and also from his connection with the Western Gas Association. We desire herewith to acknowledge receipt of an invitation to attend this meeting.

NOT WATER GAS.—A Buffalo (N. Y.) man visited Lockport, New York, on April 2, and put up for the night at the American Hotel, being assigned to a sleeping apartment in room number 14. He is reported as having the appearance of one who had imbibed too much whiskey, and, further, looked as though he not did possess any too great proportion of this world's goods and chattels; indeed the American Hotel proprietor goes so far as to say that his whilom guest's baggage resembled very much that carried around by a peripatetic vender of lemons. At any rate, early the following morning, one of the hotel employes, in passing the room occupied by the stranger, detected the smell of escaping gas, and at once reported the circumstance at the office. The door of the room being locked, and repeated knocking failing to

elicit a response, the apartment was broken into, and the occupant found lying in bed in a state of unconsciousness. An examination of the bracket light showed the burner turned full on, and the generally put forth theory of a case of "blowing out the gas" was accepted as reason for the escape. The sufferer, on being brought into a pure atmosphere, revived sufficiently to walk off without a word of explanation, or giving thanks for the fact that he had been inhaling coal illuminating gas, despite the wonderful Lowe suggestions concerning marsh gas. Somebody ought to suggest that the "great aeronaut" had better take out a patent on this latest "discovery"—*i. e.*, the terrible effects developed through the high percentage of marsh gas contained in illuminating gases made from bituminous coals. Considering the antiquity of some features that he has been enabled through the generosity of the Patent Office to claim as original, we do not see why he should not have the Washington stamp affixed to the marsh gas business. If the Buffalo peddler had happened to be in some one of the hotels below Canal street in New York city, instead of at Lockport, under the circumstances detailed above, we do not suppose he would have explained whether he blew the gas out or not—and, at the same time, we do not think he would be able to walk off.

Price of Gas Reduced at Hannibal, Mo.—Mr. J. H. Decker, whose connection with the American Water Works Association is chronicled above, has caused to be issued, to the gas comsumers of Hannibal, Mo., the following circular:

"On and after April 1, 1884, the price of gas will be reduced from $3.00 to $2.75 per 1,000 cubic feet, subject to following discounts:

On all bills under $30 .... 10 per cent.
" " over $30 ..... 15 " "

provided, however, that full settlement of accounts be made on or before the sixth day of each month. Four years ago reduction was made to all consumers, in the hope that an increased consumption would justify the course. The hope being fully realized, a second reduction was made the following year. Again the company has decided upon a similar plan, and asks your liberal co-operation and support; we further promise that the price charged for gas shall at all times be kept at as low a figure as consumption will warrant." Not a great many monopolistic sentiments are to be found in this announcement, notwithstanding that the Hannibal Company has the field to itself; and no better means can be taken to preserve the field intact than by continuing the policy thus inaugurated.

Some of the Lowe Candle Power Gets "Lost" at Harrisburg, Pa.—Everybody knows that the United Gas Improvement Company are operating a leased gas plant at Harrisburg, Pa., and are furnishing a pure, unadulterated Lowe water gas to the consumers of that city. We have always understood that Harrisburg was "one of the brightest jewels in the Lowe diadem," the gas product there being exceptionally pure, startlingly luminous, etcetera, and so-forth, and so on. We would not have the hardihood to assert anything to the contrary on our own individual account, but will just here submit in evidence a clipping from the Harrisburg *Independent*, dated March 24.

"Consumers of gas in this city wil take comfort in the fact of short evenings, for the long nights of departed winter were made doubly gloomy by the miserable means of illuminating homes and business places supplied at high prices by the Harrisburg Gas Company. Under these conditions there was less reading done at night last winter in this city than was enjoyed for the past 20 years—simply because the gas light was inadequate."

Since philanthropic motives were so freely advanced by the Lowe concern in the arguments before the Committee of Manufactures of the Massachusetts Legislature, can it be possible that the Harrisburg branch of the syndicate wishes to preserve the eyesight of Harrisburg's citizens on the ground that reading print at night is filled with optical danger?

The Fatal Kerosene and Festive Benzine.—Considerable excitement was occasioned in Philadelphia, Pa., on April 2, through a fire, which occurred in the store of Simon & Co., on North Front street in that city, kindled by an explosion of a quantity of benzine. Charles Simon, one of the firm, together with an employee, name unknown, were badly burned. The loss accruing is numbered in thousands. On the same date a woman named Kate Bailey, living at Fleetwood, N. J., attempted to hurry up the building of a fire in a cooking stove by the aid of a kerosene can. The vessel containing the oil exploded, and the unfortunate woman was burned to death. We have laws purporting to govern the sale and distribution of this death dealing fluid, but the refining interest is powerful enough to laugh at them.

Mr. John P. Harbison, of Hartford, Conn., Heard from.—Mr. John P. Harbison may properly be given the credit of being one of the pioneers in the matter of selling illuminating gas in the United States at low figures. Certainly this statement holds good for the Eastern section of the country. Mr. Harbison practices what he preaches, as the Hartford Company's price of $1.80 per 1,000 cubic feet shows; but the $1.80 rate is doomed, and will soon give way to a smaller charge. In fact, we doubt very much whether our go-ahead citizen of the "Nutmeg State" will be satisfied until $1.50 per 1,000 is reached. While Mr. H. believes in cheap gas he also adheres as firmly to the idea that his stockholders should receive a fair return on the money invested, and aims to pay between 8 and 10 per cent. on the capital stock. The price of the Hartford Gas Light Company's stock has always ruled at about even figures, its fluctuations generally only ranging between "dividend-on" and "dividend-off;" our last quotation showing the figure of 128 bid, asked 135. If a fortune cannot be made, at one turn, in Hartford stock, the reverse of the case shows that a fortune may be kept by simply holding on to it. So much for Hartford's cheap gas, and Hartford's "safe" gas stock; now to come to the true inwardness of the last time we heard from Mr. H. Among the many ways of convincing his stockholders that more money can be made by selling gas at low than at high figures, he has arrived at the conclusion that if his directors were kept posted as to what was going on in the gas world, they would all the more readily see the cogency of his arguments. According to this conclusion he gave us orders to send a copy of the Journal to each of his directors, and handed us a check for $27 in settlement of the bills for subscription. Naturally enough we think this is about the proper thing to do, and doubt not but that Mr. Harbison's action will result beneficially to himself and the Hartford Company. Directors of gas companies, no matter how large their monied interests may be in gas undertakings, do not, as a rule, appreciate the complexity and magnitude of the responsibilities borne upon the shoulders of their engineers and superintendents, until they themselves (the directors) have such things brought under their examination by careful study of the many abstruse problems constantly cropping out in the manufacture and distribution of illuminating gas. We desire to thank Mr. Harbison and the Hartford Gas Light Company for this substantial recognition of our endeavors to represent the best interests of the American gas maker.

Buoys Lighted with Compressed Gas.—On April 2, the United States Lighthouse Board was informed that marine buoys lighted with compressed gas had been placed off Cape Charles and Cape Hatteras.

The Nassau Gas Light Company, of Brooklyn (N. Y.) Ceases Aggressive Operations.—A rumor reached the Journal office, on Saturday, April 5, that the Nassau Gas Light Company had stopped pipe-laying operations in the district supplied by the Peoples Company. That the rumor possessed all the elements of truth was speedily learned. The precise terms of the agreement under which the cessation of hostilities was agreed to have not transpired; but we believe that the Nassau Company dictated the bargain, and made its own terms. We are sorry that any dicker was entered into by the Nassau management, since we always thought (and nothing has occurred to shake the belief) that this company held the key to the situation in the Brooklyn gas war, and had the weapons at command whereby that particular gas bladder, so carefully inflated under the "nursing" tactics of the Standard blowers, could be certainly and effectually punctured.

A Decidedly Wrong Statement Corrected.—In the last number of the Journal there appeared an article, on "Lighting New York City," the publication of which, from the gross errors contained therein, is simply unpardonable, and which we cannot sufficiently apologize for. The only *amende* we can offer is to give the *facts* now as they should have been noted then. It was stated that the United States and the Brush Electric Lighting Companies, at the meeting of the Gas Commission held March 21 last, when the proposals submitted for lighting the streets of New York city for the year ending April 30, 1885, were opened, it was found that the offer of the first-named electric company was to light 282 lamps, while the Brush company bid for 475, "or precisely the same number supplied by them during 1883." While the two electric companies did bid on the respective numbers of 282 and 475 lamps, they only maintained during the last fiscal year 55 lamps and 73 lamps, or a total of 128 for both, as shown by the report of Mr. Stephen McCormick, Superintendent of Lamps and Gas, of the operations of his department up to December 31, 1883. The total cost of the 757 lamps, at the prices charged, would be $193,413.50 per annum; but the fact is that the 128 lamps actually maintained cost $32,704. It is understood that the appropriation for street lighting for the fiscal year ending April 30, 1885, has been increased, over that applied to the same purpose for period ending April 30, 1884, by a sum to the extent of about $70,000. This being so, and supposing the entire $70,000 were devoted to extension of the arc street lighting system, it would still fall far short of meeting the expense incurred by an acceptance of the electric companies bids based on a maintenance of 629 additional lights. We have no reason to retract the assertion that the electric lighting forwarders are anxious to extend the magnitude of their street lighting operations in New York city, be they either specially interested in the Brush or United States systems. They knew fully well, when submitting

the estimates for the great prospective combined increase of 629 lights, that, even were the Gas Commission ever so willing to grant them all that was bid for, at best, or worst, as the case may be, only a moiety of the new business could be assigned for purposes of increasing the "arc" illumination area. In short, the bids of both the electric companies may be looked upon as a sort of "bluff," to influence speculations outside of New York city.

STREET LIGHTING AT TORONTO, CANADA.—We have received through the kindness of Mr. Pearson, of the Consumers Gas Company, of Toronto, Canada, an interesting budget of news relative to the street lighting operations in that city. The electric folks seem disposed to contest the territory this time; and in view of the fact that the present street lighting contracts between the city and the Consumers Company are about approaching the completion of the period of time specified for their termination (terminating on May 15) tenders for lighting were recently handed in by the gas company and two electric companies. Under the old contract the Consumers Company maintained, in the ten wards of the city proper, 2,419 gas lamps at an average annual total expense of $55,347, the contract being a ten year one, making the average annual price of each lamp approximate to $23. The lamps have remained unlighted during six nights of each month, unless otherwise ordered by the authorities; and when, from any cause, such lighting was demanded, the city was obliged to pay therefor the sum of about $200 extra per night. Owing to lack of space in this issue we are unable to here reproduce the terms of the new bid of the Toronto Company, which is a lengthy and interesting document, and made to cover a period of ten years, commencing May 15, 1884. We will say, though, that the new offer of the Consumers Company is a very advantageous one to the city; an all night (3,700 hours) service being provided for, and a less rate charged for the same than is now paid for the intermittent schedule. The Toronto Electric Light Company offers to furnish 50 lights at the rate of 65 cents per light per night, each light to be burned not less than 3,600 hours per annum, and (of course?) to be of a nominal illuminating power of 2,000 candles. The district to be thus illuminated to be picked out of the heart of the city, and even then the electric people could only make the showing of displacing four gas lamps to each "arc" light, as the distance intervening between the city's gas posts is, on the average, 150 feet. The Canada Electric Light Company offered to furnish any number of lights called for at 62 cents each per night—for candle power see as above, they never make any difference in this respect. When the awards are finally made we will give the full text of the contracts submitted. Mr. Pearson furnishes the following figures in regard to some American cities where the electric light has been adopted as a street illuminator, showing displacement of gas lamps effected and distances intervening between each electric lamp:

Detroit,	300 to 500	feet	apart	4	gas lamps.
Cleveland,	" " 700	"	"	5	" "
Rochester,	" " 500	"	"	6	" "
Buffalo,	" " 700	"	"	7	" "
New York,	" " 500	"	"	7	" "

The cost per annum in each city is, Detroit, $182; Cleveland, $219; Rochester, $164.25; Buffalo, $200.75; New York, $255.50.

The Consumers Company's bid also submits proposals for the maintenance of an improved high-power system of gas lighting at important points in the city. We will recur to this subject again.

SOME FACTS FROM SUPERINTENDENT MCCORMICK'S REPORT.—From the report of Mr. Stephen McCormick, Superintendent of Lamps and Gas, of New York city, to the Department of Public Works, for the quarter ending December 31, 1883, we find that the various companies supplying gas in New York city, laid 31 miles 298 feet of various sized mains during 1883. The six leading companies are shown to have the following mileage:

	Miles.	Feet.
New York Gas Light Company	112	3,296
Manhattan " "	175	1,286
Metropolitan " "	143	4,100
Mutual " "	120	400
Municipal " "	76	1,458
Harlem " "	132	3,087

and the total length of mains of all the companies in the city, including those supplying gas in the outlying territory annexed to the city a few years ago (the entire number being 11) shows the figures of 929 miles, 399 feet. The Municipal mileage should really include the main system of the Knickerbocker Company, as the two concerns are actually one, so far as output is concerned. The Municipal main system should therefore be increased by the addition of 67 miles, 4,385 feet, that being the length credited to the Knickerbocker Company in the report. Naturally enough some curiosity exists outside of New York city to know what the Equitable Company has been doing since the commencement of building operations by that concern. An examination shows that work has been actively prosecuted, and a plant of excellent construction is being erected on the two blocks of land lying between 39th and 41st streets, and First avenue and East River. In the month of May last the Equitable Company began the laying of mains, under permission given by the Gas Commission in December, 1882. Up to December 31, 1883, the following pipe work was done:

Sizes.	Lengths.
Six-inch main	15,507 lineal feet.
Eight-inch main	26,721 " "
Twelve-inch main	25,338 " "
Sixteen-inch main	16,743 " "
Twenty-inch main	10,124 " "
Twenty-four-inch main	7,213 " "
Total	101,646 lineal feet.

and it has paid into the City Treasury 20 cents per lineal foot, as required by the conditions prescribed by the Gas Commission, amounting in the aggregate to $20,329.20.

On date of December 31, 1883, the various companies supplying gas were employing the following process:

New York Gas Light Company, water gas, "Tessié du Motay" process; Manhattan Gas Light Company, coal gas; New York Mutual Gas Light Company, from pine wood and naphtha and coal; Metropolitan Gas Light Company, from coal and naphtha; Harlem Gas Light Company, coal gas; Municipal Gas Light Company, water gas, "Tessié du Motay" process; Knickerbocker Gas Light Company, water gas, "Tessié du Motay" process; Central Gas Light Company, coal gas; Northern Gas Light Company, coal gas; Yonkers Gas Light Company, water gas, "Slade" process.

MESSRS. PERKINS & CO., LOCATED IN NEW OFFICES.—Messrs. Perkins & Co., formerly at No. 45 South street, in this city, Sales Agents for the Ocean Mine Youghiogheny coal, and importers of English and Scotch cannels, have removed to their new and elegant offices at Nos. 228 and 229 New York Produce Exchange Buildings. Their new quarters are handsome and commodious.

THE SHELDON GAS STOVE COMPANY'S RECENT EXHIBIT.—On the evening of Thursday, April 10, the Sheldon Gas Stove Company gave an excellent exhibition of what a sensibly constructed gas stove can do in the way of cooking at their sales-rooms No. 18 West 23d street, New York city, particular attention being called to the operation of the Sheldon air-tight combustion chamber. The edibles were cooked in full view of the numerous assemblage gathered to inspect the cooking and "atsorb" the "cooked." The exposition was a complete success.

Correspondence

[The JOURNAL is not responsible for the opinions expressed by correspondents.]

"J. S." not Disposed to Admit that His Reasoning is Fallacious.

NEW YORK, April 8, 1884.

To the Editor AMERICAN GAS LIGHT JOURNAL:

The communication of "E.," in your last number, so far from proving that my remarks were in any way fallacious, shows that "E." himself is laboring under a very serious fallacy—the mistake of supposing that ammonia, *per se*, acts as a purifier. Hence his curious reflection about my taking all the ammonia out of the gas in the scrubber, "the very ingredient which I value so highly as a purifier." He cannot understand how I can purify the gas with a substance which I am actually taking out of the gas. He has tried the remarkable experiment of reducing that quantity of water in the scrubber, and still found ammonia in his purifiers; certainly he will find it, and also in the street mains and meters as well. Ammonia, in an uncombined state, or free ammonia, has no power to take up CO_2 or SH_2. It is only when it is in the form of ammoniacal liquor that it will remove these impurities, hence my statement, which I reaffirm, and have had amply proven in my daily experience, that the more ammonia in the water or liquor the more of these impurities will it take out of the gas; and the scrubber is not doing its duty properly if there be any free ammonia in the liquor, as it ought to have united with its proportion of CO_2 and SH_2, forming carbonate and sulphide of ammonia, this being the solution giving ammoniacal liquor its specific gravity and value.

The duty I require my scrubber to perform is not, as "E." thinks, to arrest solid matter (this ought to be taken out before the gas reaches the scrubber) nor is it to mix the gases, but only to absorb all the ammonia by the aid of water; and, when in that condition, to remove as great as possible quantities of CO_2 and SH_2, by sub-dividing and breaking up the gas, as it were, and so bringing it in contact with the salts of ammonia contained in the liquor, which in that condition, and that condition only, will remove these impurities.

J. S.

The Market for Gas Securities.

New York city gas shares are strong and higher; the most notable advances being in Metropolitan, Municipal and Manhattan. All the New York city companies proper share in the advance, and it would not be matter for great wonderment to see the figures of early spring once more reached.

The most prominent feature in the out-of-town situation is exhibited in Brooklyn gas shares, the unofficial, though none the less real, announcement that the Nassau aggressive movement had terminated, and a truce arrived at, furnishing the solution. Nassau, Fulton Municipal and Peoples shares seem to have been most favorably affected by the news—and the upward movement in all the list has been surprisingly sharp. The Brooklyn (N. Y.) Company has declared a dividend of 5 per cent., payable May 1.

Washington (D. C.) shares, naturally enough on adverse report of committee in case of the attempted opposition concern, are firmly held at advancing figures.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks (with W. B. Scott & co.,)
34 Pine Street, New York City.

April 16.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share. ☜

	Capital.	Par.	Bid	Asked
Harlem	1,800,000	50	118	121
Municipal	3,000,000	100	209	211
Metropolitan	2,500,000	100	230	—
Manhattan	4,000,000	50	267	270
Mutual	3,500,000	100	129	131
New York	4,000,000	100	152	155
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	137	140
Citizens	1,200,000	20	96	100
Fulton Municipal	1,500,000	100	130	—
Peoples	1,000,000	10	83	86
Metropolitan	1,000,000	100	92	95
Nassau	1,000,000	25	96	100
Williamsburgh	1,000,000	50	115	120

ERECTION OF SULPHATE OF AMMONIA PLANT.

Plant erected on the best known methods, or plans and specifications supplied. For terms apply to

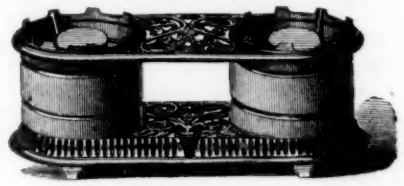
JOHN G. HARVEY, C.E., Globe Chemical Works,
596-1t Cor. Front & Cypress Sts., Toronto, Ont.

WANTED,
Position as Manager.

Wanted, by an English Gas Manager, a similar situation in an American gas works. Fifteen years' experience, with a thorough knowledge of the manufacture and distribution of gas, sulphate of ammonia, etc. At present and for last eight years manager of large works in the south of London; annual make of gas, 300,000,000 cubic feet, producing the very best results and paying 12½ per cent. dividends. Unquestionable testimonials. Leaving England on account of the delicate health of his wife. Will be at liberty July 1, 1884. Address

ROBT. WILSON, Manager,
Croydon Commercial Gas and Coke Co.,
594-3t Surrey, England.

JAS. L. SHARP,



MANUFACTURER OF THE

Dome and Etna

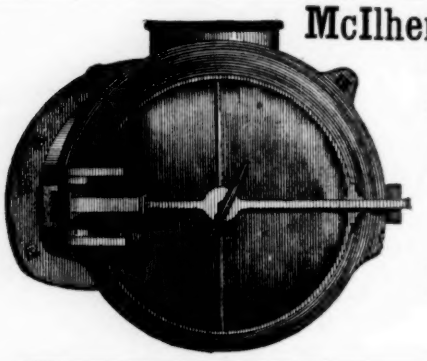
GAS STOVES,

Of all Sizes and for all Purposes.

THE MOST ECONOMICAL IN THE MARKET.

No. 10 Murray Street, New York City.

STANDARD GAS RETORT AND FIRE BRICK COMPANY,
J. ANDERSON, Pres. & Mang'r. OF IRONTON, OHIO. R. A. KIRKER, Secretary.
Clay Gas Retorts, Fire Brick, and Fire Clay Goods of Every Description.
Plans of Livesey, Somerville, McIlhenny, and other Furnaces, and Competent Workmen Supplied.



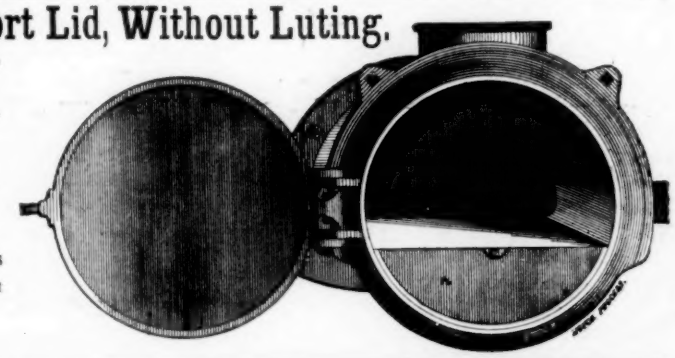
McIlhenny Self-Sealing Retort Lid, Without Luting.

Requires but Little Skill to Bolt them to an Ordinary Shaped Mouthpiece.

Saves Gas, Luting, Labor & Breakage.

E. N. GRAY & CO.,
Engineers, Founders, & Machinists,
WASHINGTON, D. C.,
Agents and Sole Manufacturers

Also Manufacturers of the Latest Improved, Most Durable and Efficient
Coke Breaker
IN THE MARKET.



WILBRAHAM GAS EXHAUSTER,
"BAKER SYSTEM,"
WITH ENGINE ATTACHED, ON SAME BED PLATE OR WITHOUT.
The Best, Cheapest, & most Durable Exhauster known.
WILBRAHAM BROS., - No. 2320 Frankford Avenue, - PHILADELPHIA, PA.